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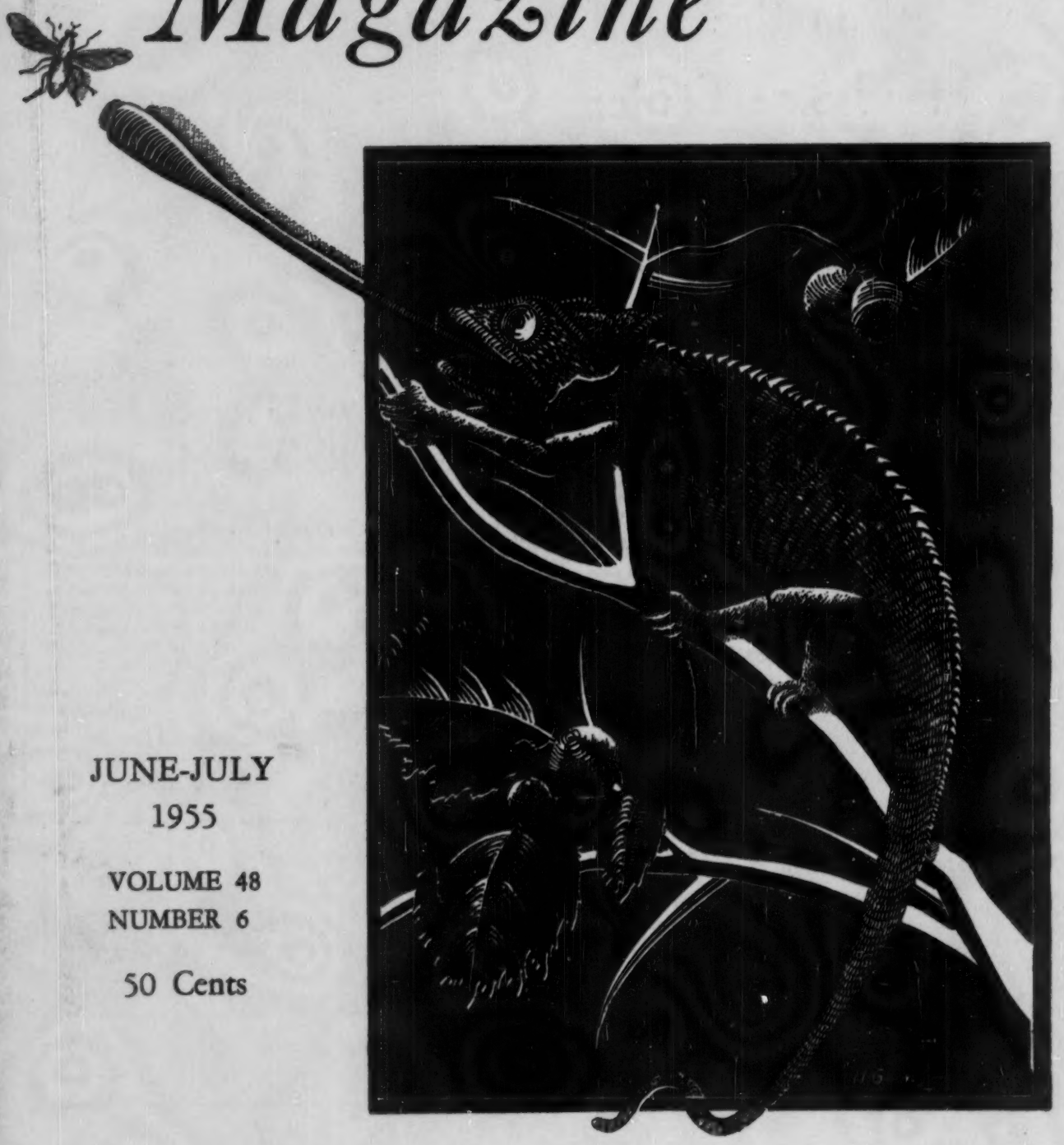

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Correspondents

From John E. DeTurck comes word that he would like to correspond with others sharing his interest in natural history, gardening and hiking. His address is 210 Penn Terrace, Mt. Penn, Reading, Pennsylvania. And from Gordon W. Browne, Owens Road, Martinsville, 1N, N.S.W., Australia, comes word that he would like to exchange correspondence with folks interested in birds and mammals.

Animal Genius

A noted scientist, whose research dealt with the careful measurement of animal intelligence, once set to work with the aid of his assistants to devise a series of four learning problems. It was planned to test the intelligence of chimpanzees by noting which ones could solve the progressively more difficult problems and thus secure a reward for their efforts.

The chimps were duly put through the four learning tasks, and most of them succeeded but at different rates of speed, which would have been the case with human learners. However, much to the surprise and consternation of the scientists, one extra bright chimp actually showed them how to solve the problem series by a *fifth* method!

The scientist failed to state whether he eventually added this chimp genius to his staff!

JOHN A. BLAKE

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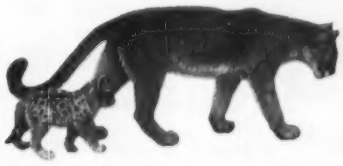

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JUNE-JULY 1955, VOL. 48, NO. 6

Published by the **AMERICAN NATURE ASSOCIATION** to stimulate public interest in every phase of nature and the out-of-doors, and devoted to the practical conservation of the great natural resources of America

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Reviews

Daniel 'Coon

By Phoebe Erickson. New York. 1955. Alfred A. Knopf. 179 pages. Illustrated by the author. $3.00.

Daniel, as may be gathered from the title of this entertaining book for boys and girls, was a raccoon. In fact, he was a raccoon that the author herself raised and of whom she made the charming illustrations that illuminate the pages of the book. However, for the purposes of her story, Miss Erickson places this orphan in the hands of young Tacks Foster, who became foster parent to the young raccoon when a storm blew down the tree in which he had lived the few days since his birth. Daniel turned out to be a delightful and interesting pet and companion, and in this story he is the means of teaching his young friends many things about the outdoors and about wildlife. This story is written with all the understanding and charm of the author's earlier book, *Black Penny*.

Nature Parade

By Frank W. Lane. New York. 1955. Sheridan House. 333 pages. Illustrated. $5.00.

In gathering the material for this interesting book the author says that he consulted more than 1000 books and some 5000 magazines, monographs, abstracts, newspapers and specialist journals. In it he attempts a synthesis of observations made by naturalists, explorers, scientific workers and chance observers. He is primarily interested in animals in their native habitats. Mr. Lane divides his book into sections dealing with the private lives of animals, their speed and locomotion, and reports of animals that probably do not really exist. The author has gathered an immense amount of interesting and informative material for the average reader with a concern for animal life. The result is a readable and engrossing book.

How to Watch Birds

By Roger Barton, New York, 1955. McGraw-Hill Book Company. 229 pages. $3.50.

If there is anything that Roger Barton, president of the New Jersey Audubon Society, has overlooked in this practical guide to bird watching we have not been able to detect it. With a life-long avocation of bird observation, he combines experience as advertising man, newspaper reporter and editor, this background specially equipping him to deal effectively with his subject. He estimates that there are close to 10,000,000 bird watchers in the United States, which includes those who go afield for the special purpose of observing birds and those who attract birds by providing homes, food and other evidences of hospitality. This is a considerable army, and it is to its members and its potential recruits that this useful book is directed. From its introductory chapter on "What Is a Bird Watcher?" to its final chapter, presenting brief biographies of some famous watchers, we heartily recommend Mr. Barton's contribution to the furtherance of a fascinating hobby.

Bird Houses

By L. Day Perry and Frank Slepicka. Peoria 3, Illinois. 1955. Charles A. Bennett Co. 96 pages. Illustrated. $1.75.

In this book we have a guide to the provision of bird residences. Following a chapter on the birds that will occupy nesting boxes, the authors discuss the principles of nest-box construction and then the details of building. Plans are provided for the do-it-yourself individual. There are also chapters on feeding shelves and shelters, and on the protection of bird tenants against enemies. This is a most practical and useful book.

Briefly Noted

Little Dog Sniff and the Twins. By Geraldine Foster Smith. New York. 1955. E. P. Dutton & Co. 86 pages. Illustrated by Robert Henneberger. $2.50. Story for the youngsters about a Scotty and his twin pals, Ricky and Roddy.

Here Come the Deer! By Alice E. Goudey. New York. 1955. Charles Scribner's Sons. 94 pages. Illustrated by Garry MacKenzie. $2.25. A nice little story for the quite young reader.

Two Years in the Antarctic. By E. W. Kevin Walton. New York. 1955. Philosophical Library. 194 pages. Illustrated. $4.75. Personal account of two years spent in the British Antarctic since the conclusion of World War II.

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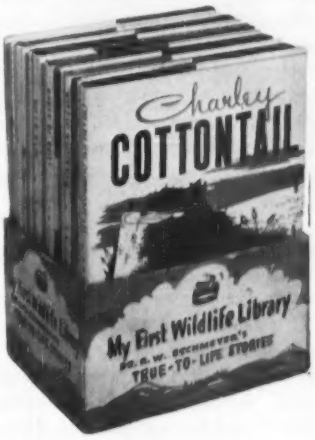

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Nature IN PRINT

By HOWARD ZAHNISER

This is Dinosaur

WHEN THE UNITED STATES SENATE on April 20, 1955, by a vote of 52 to 30, refused to delete the Echo Park proposed dam from the Upper Colorado River Storage Project, and then proceeded to pass the bill that would authorize the project, the Senators tightened the tension of the greatest controversy that American conservationists have faced in the four decades during which the United States has owned a National Park System—the controversy over whether to permit the building of this dam in the Dinosaur National Monument, a unit of the National Park System in northeastern Utah and northwestern Colorado.

Once before, the preservers of national parks had faced such an issue and had finally lost—in 1913, when the United States Senate passed the Raker Act that authorized the O'Shaughnessy Dam in the Hetch Hetchy Valley of Yosemite National Park. It was that defeat which led, three years later, to the establishment of a National Park System, the authorization of a National Park Service to administer the system, and the careful definition of the purpose of the parks and monuments that comprise the system. This accomplishment in the National Park Act of 1916 has seemed, through all the years, a consolation of great magnitude for the loss of the Hetch Hetchy Valley and for the defeat of park preservationists in the controversy that preceded that loss.

Never until now has this policy been seriously threatened, but with an Administration in which both the Secretary of the Interior and the President have agreed with the sectional leaders of the Upper Colorado Basin in endorsing their project, and with the passage of the bill by the Senate, there is no possible saving force between citizens concerned with the preservation of their parks and the destruction threatened by the Echo Park Dam except the influence of their Congressmen in the House of Representatives. If this Echo Park Dam hazard to the continuation of a public policy of national park preservation is to be removed it must be done by the Members of Congress in the House of Representatives. And if they are so to act—and soon—it will only be in response to letters, telegrams, and personal visits from their constituents. Conservationists thus have a tense and immediately pressing responsibility to make their influence felt by their representatives in Congress.

A false vision

On the day when the Senate in 1913 took final action authorizing the Hetch Hetchy project in Yosemite National Park, an artist's imaginary drawing was placed on the desk of each Senator representing the false vision conjured up of a beautiful lake impounded by the dam. At the head of this drawing was the question "Does this beautiful lake ruin this beautiful valley?"

In our year 1955 not only did the Senators have this same drawing, as a reminder, but also photographs of the Hetch Hetchy Valley as it is now—photographs in a folder entitled *What Is Your Stake in Dinosaur?*

Did the 1913 predictions come true? asked Senator Hubert Humphrey of Minnesota, and he answered:

"No. You have only to look at the picture of Hetch-Hetchy today to see how wrong were the prophets of 1913."

"Open once the folder called *What Is Your Stake in Dinosaur,*" Senator Humphrey continued, "and see, above, the beautiful scenes of Hetch Hetchy half a century ago and then see the picture, below, of the reservoir today. That picture points to the fallaciousness of the reasoning that Echo Park will be improved by a dam. The photograph of Hetch Hetchy today shows a bleak expanse of dead water, made particularly ugly by the fluctuating water levels which expose stumps of dead trees and the muddy, rock-strewn shores."

Senator Humphrey and all his colleagues in the Senate had received this folder, *What Is Your Stake in Dinosaur?* laid inside the front cover of one of the most beautiful books that has come my way in some time. Entitled *This is Dinosaur: Echo Park Country and Its Magic Rivers*, with 47 magnificent photographs, 8 of them in full color, this volume—written under the editorship of Wallace Stegner and expeditiously published in a three-months period by Alfred A. Knopf—had carried to each member of the Senate some representation of the values of the area threatened by the dam proposal they were facing. No fanciful vision of misleading prospects, this document was and is a faithful representation of the superb area of the earth that is here at stake, and that also now represents for us, in our policy decisions, all such areas that we seek to preserve in their pristine natural beauty.

Five-year controversy

In a controversy that has been increasing in tension for five years there are of course many arguments, some of them inescapably, perplexing some of them confusing by the intention of those who propound them, but all of them come back to the character of the area of our good earth that is the scene of the preservation and the site of the proposed dam. It is because the scenic wild canyons of the Green and Yampa Rivers in the Dinosaur National Monument are superbly beautiful and marvellous that they have been set aside in a National Monument. The National Park System exists for the precise purpose of serving as a means for saving such areas. It is this consideration that makes the proposed Echo Park Dam not only a possible desecration of a superlative part of the still remaining American wilderness, but also a threat to an instrument of public policy which has been devised to protect such areas. If the National Park System can not successfully protect this area, how can any such areas in our democratic America be protected? What hope is there for any program that would preserve some natural areas unspoiled, if the great hope represented by the National Park System, sanctified by four decades

of respect by the American people, can be crushed by the proponents of this Echo Park Dam?

A copy of *This Is Dinosaur: Echo Park Country and Its Magic Rivers* has, however, gone not only to each member of the United States Senate. One also has gone to each Member of Congress in the House of Representatives, who must yet act on this project before it can be authorized by law. There actually is much encouragement, in view of the circumstances, in the fact that as many as 30 Senators voted against the Echo Park Dam and that only 52 of the total 96 supported it. (Ten Senators from the region affected by the huge proposed project of which Echo Park Dam would be a unit had sponsored the bill. Members of the Senate reluctantly oppose their colleagues on matters regarding the States which their colleagues represent.) In the House of Representatives the results may well be much different, and the influence of such a volume as this may indeed be tremendous and determining.

All who can, will wish to own this volume, to see for themselves so vividly and clearly represented the character of these deep canyons that have become the center of such a momentous controversy, and certainly an acquaintance with the book —at home or in a public library— will better enable a conservationist to communicate his influence to his Congressman.

Council of Conservationists

Among the organizations that have encouraged the publication and distribution of this book is the Council of Conservationists at 161 East 42d Street, New York 17, N.Y., for which this reviewer is the Washington representative. This, his readers may understand, may explain (and, he hopes, excuse) his earnest pleadings for a cause, in discussing a volume that is itself not controversial. If readers of this page, fortified with the information of this book, or simply with their own sense of park values, would write to their representatives in Congress, urging them to oppose the whole Colorado River Project, because the Senate has now made Echo Park Dam a part of this project, and then would let the Council of Conservationists know what each Congressman said in reply, it would greatly facilitate the further efforts to protect this superb area, and the policy through which the American people are seeking to preserve it and the other natural areas which they cherish.

But, finally, it must be emphasized that this volume, *This Is Dinosaur*, is itself not characterised by controversy. As its brilliant editor, the writer of its foreword and eloquent introduction, Wallace Stegner, says:

"Though the writers, scientists, and photographers who have combined in these pages are all unalterably opposed to the suggested Echo Park and Split Mountain dams, they have not chosen to make this book into a fighting document....The purpose here is simply to survey its possibilities for human rest and recreation and inspiration, in the belief that the people and Congress of the United States should have a very clear idea of what they would be losing if they chose to sacrifice this National Monument to make a reservoir."

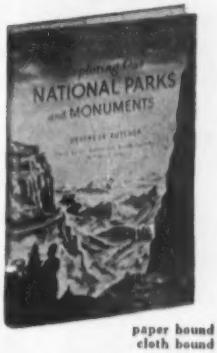
This Is Dinosaur: Echo Park Country and Its Magic Rivers. Edited by Wallace Stegner. New York: Alfred A. Knopf. 1955. viii + 97 pp.(7⅜ by 10¼in.), with 47 photographs on 38 pages, 8 in color; end-paper map of "The Dinosaur Country" by Marion and Don Greame Kelley; and note on the contributors. Foreword and Introduction, "The Marks of Human Passage," by Wallace Stegner and chapters as follows: "Geological Exhibit by Eliot Blackwelder; "The Natural World of Dinosaur," by Olaus Murie and Joseph W. Penfold; "The Ancients of The Canyons," by Robert Lister; "Fast Water," by Otis "Dock" Marston; "A Short Look at Eden," by David Bradley; and "The National Park Idea," by Alfred A. Knopf. $5.

Mammals

By Herbert S. Zim and Donald F. Hoffmeister. New York. 1955. Simon and Schuster. 160 pages. Illustrated in color by James Gordon Irving. $1.00 paperbound; $1.95 clothbound.

This is the seventh and latest in the "Golden Nature Guide" series brought out by this publisher and maintains the excellent standard of a simple and introductory guide established by the predecessor books. There are illustrations in full color of 218 mammals, and distribution maps for each species. The text is concise. Mammals of the sea are also included, and the guide is confined to the more familiar American species.

Going exploring this summer?



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Liberty Hyde Bailey (1858-1954) when he was Dean of the College of Agriculture at Cornell about 1910.

Liberty Hyde Bailey

In writing of the late Liberty Hyde Bailey it is a temptation to think of him as one of Cornell's most famous professors. This would be inaccurate because he was more than a professor, and he served many other institutions. One could think of him as being famous because of his intense alertness after he had lived more than ninety years. But there are many memories of him when he was younger, giving me kindly and yet severe criticism of some research I had completed, introducing me to Rupert Brooke's "Great Lover," talking to a small group of us in a hotel dining room after the lights had been out for a half-hour and making us share his experiences in open boats in the Caribbean, or poring over some of his herbarium sheets while I took some moving pictures of him. Possibly my most memorable recollections of him center around a hayride in 1911 to his home outside Ithaca, and witnessing the masterful way in which in 1950 he conducted a business meeting of a group that was famous for getting nothing done in as long a time as possible. For once they accomplished something.

It is ridiculous to attempt to evaluate Dr. Bailey, who passed away December 24, 1954, in his 97th year, by personal experiences alone. He was an institution by himself, well known by those with whom I have had dealings, whether I was in New Zealand or western Europe, and better known in areas that I never have visited or never will.

He had an intense faith in the Nature Study Idea, and was the first president of the American Nature Study Society. His support of the philosophy did much to help it gain recognition. Although he authored and edited many of the most substantial source books in the field of botany and agriculture, he was proudest of his *Holy Earth*, which dealt with his philosophy of life.

On Professor Bailey's 85th birthday he said that he had written 65 texts and had never dictated a manuscript. Instead he wrote everything out longhand and rewrote much of his material repeatedly.

Bailey said: "I happened to be traveling on the highway of life when various movements came along. I jumped aboard and have had a wonderful time." Speaking of a friend whom he admired he said, "It is not only what a man knows. It's the radiance of his life; not only his knowledge that counts but the resilience of his life." Speaking also of a book that bored him, he once told me: "If there ever should be another flood, to this book I should fly. It, at least, would be dry." Of himself and his joy in life he once said, "I feel as if I am looking at a cloud, wandering in a fragrant fog."

It would be splendid if those who knew him best would collect his reminiscences which he shared so generously through most of his life. It would make an intriguing book, and present a unique picture of his experiences in all the major continents of the world except Africa. It would be welcome in these days of international high tensions. Will Roger's philosophy might have laughed us out of situations that led us into the Second World War. Application of David Starr Jordan's philosophy might well have helped in the solution of the situation that resulted in World War I. It is doubtful whether anyone living as a contemporary of Liberty Hyde Bailey contributed as much to a wholesome appreciation of life itself, particularly in rural areas, as did he.

E. LAURENCE PALMER

Wildlife Awards

To Dr. Clarence Cottam, dean of the college of biological and agricultural sciences, Brigham Young University, and former chief of the U. S. Fish and Wildlife Service, went the coveted Aldo Leopold Memorial Award of The Wildlife Society for 1954. Allen W. Stokes of the Ontario Department of Lands and Forests received the award for the best publication on a terrestrial wildlife species in 1954, and Dr. W.E. Ricker of the Pacific Biological Station, Nanaimo, B.C., received a companion award for the best fisheries paper of 1954. The Society's conservation education award went to Durward L. Allen for his outstanding book, *Our Wildlife Legacy*. Another award in this category was made to Ted Pettit for his leadership in developing conservation as the 1954 national good turn theme of the Boy Scouts of America.

Trail Trips

Fifteen trail trips through unspoiled wilderness areas are scheduled for the Trail Riders of the Wilderness by the American Forestry Association, 919 17th Street, N.W., Washington 6, D.C. These are non-profit trips and vary in length from ten to twelve days. There will also be a canoe expedition in the water wilderness of the Quetico-Superior in Minnesota. Full details are available from the American Forestry Association.

Conservation Film

Completion of a 28-minute conservation film, 16mm color and sound, is announced by the Izaak Walton League of America, 31 No. State Street, Chicago 2, Illinois. This film has been made possible through the cooperation of Johnson Motors, and is the first in a series dedicated to preserving the Nation's soil, water and wildlife resources. Information about the film is available from the League.

Hunting and Fishing

According to figures released by the U. S. Fish and Wildlife Service, 18,580,813 men and women paid $38,927,735 for all categories of State licenses, permits and stamps in order to fish during the fiscal year ending June 30, 1954. A total of 14,073,386 gunners paid $46,047,781 for State resident and nonresident licenses, permits, tags and stamps in order to hunt. This includes $4,593,256 for migratory waterfowl hunting stamps. Increases were registered in both categories.

Contents noted

BY THE EDITOR

NATIONAL PARKS AND MONUMENTS, national forests and other special-purpose areas enjoy a recognized legal status that protects them. This is not the case with our important system of National Wildlife Refuges. For example, the important Tule Lake National Wildlife Refuge in northern California is, in part, coveted for homesteading, and pressures are being brought to bear to reduce the reservation for such purpose. In Oklahoma the Army would like to get some of Wichita Mountains Refuge for an artillery range and thus ruin this outstanding wildlife area. The refuge system has been created slowly, and with each area playing an important part in the whole program. These areas are so essential to the administration of our wildlife resources, especially migratory waterfowl, that they should be given effective protection. Congressman Lee Metcalf of Montana seeks to do this through H.R. 5306, a simple and highly desirable bill that provides "that for the purpose of wildlife conservation it is the policy of the Congress to maintain and preserve the areas of the national wildlife refuges; and the Secretary of the Interior shall not dispose of, or relinguish any of the national wildlife refuges, or parts thereof, without the prior approval of the Congress."

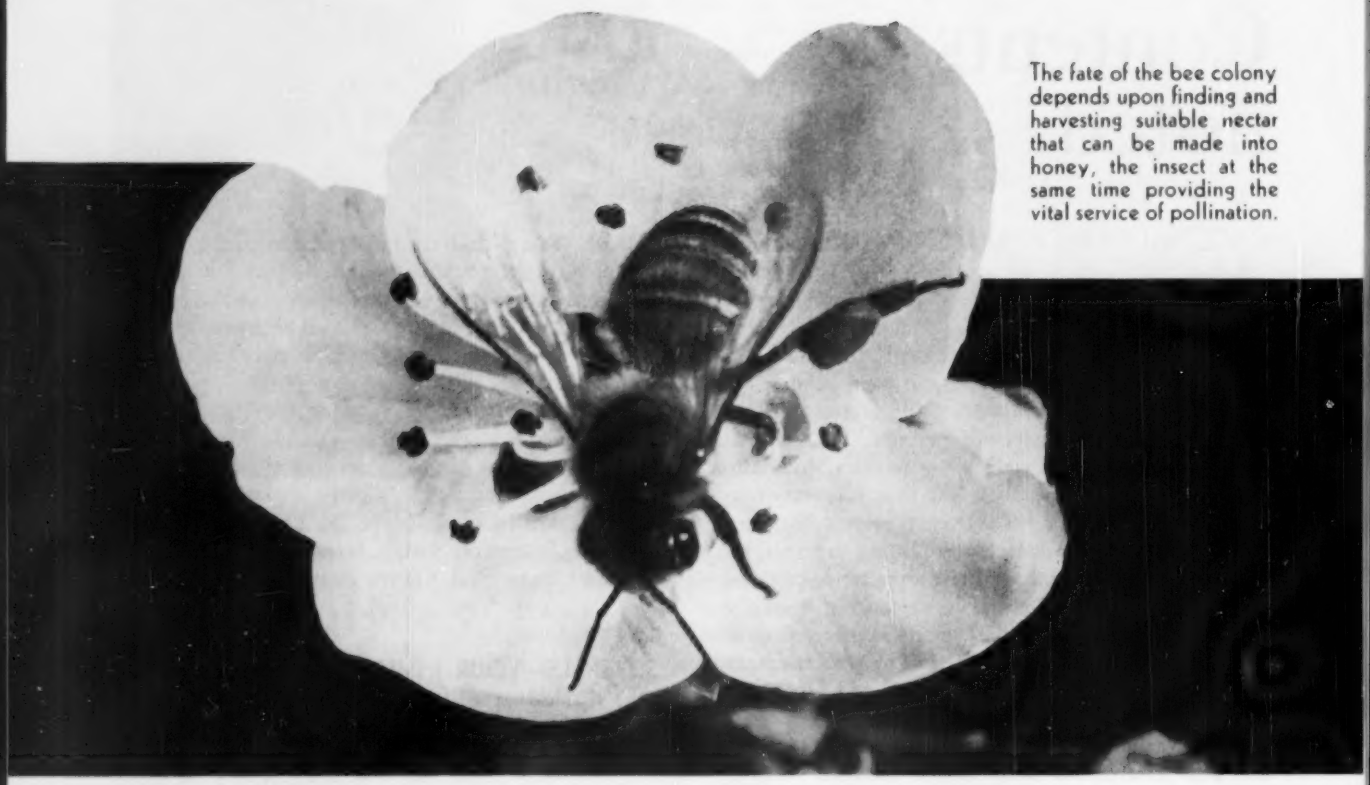
IN SHARP CONTRAST WITH THE Army's desire to exploit the Wichita Mountains National Wildlife Refuge is the recently announced action of the British Royal Air Forces. Word comes from the International Union for the Protection of Nature in Brussels that Britain's flying arm has a concern for wildlife protection. During the months of July and August thousands of sheld-ducks —the entire population of Europe—settle on the sand banks near Knechtsand, off the northwest coast of Germany. There they moult and are temporarily flightless. This area is also the site of the Cuxhaven Bombing Range, where air force practice maneuvers are held, and, in 1954, at least 12,000 birds were destroyed by bombs. Advised of this situation, the British Royal Air Forces readily agreed to halt regular maneuvers and to use as practice bombs small and harmless charges with no blast effect.

E. LAURENCE PALMER RETIRED as Professor of Nature and Science Education at Cornell University on June 30, 1952, and after thirty-three years on the faculty. During his tenure, a long procession of graduate students worked under him and are now leaders in conservation. Many of these men and women were aided by grants from the American Nature Association. We now learn that some of "Doc's" former students have established the E. Laurence Palmer Scholarship Endowment Fund, which has already passed the one-thousand-dollar mark. The income from this fund is to be used to assist graduate students whose interests are in harmony with those of Professor Palmer. The fund will stand in perpetual recognition of his many and substantial contributions. This is, indeed, an appropriate and practical applause for work well done. Anyone desiring to swell the fund may send contributions, properly designated and in favor of Cornell University, to Dr. Philip G. Johnson, Chairman, Section on Nature, Science and Conservation Education, Stone Hall, Cornell University, Ithaca, New York.

"SCHOOLS—YOUR INVESTMENT IN AMERICA" is the theme that will be emphasized this year during American Education Week, November 6 to 12. "Wishing for good schools is not enough," says the committee sponsoring the observance. "Communities have good schools when the people want them enough to take an interest in them, to work for them, to cooperate with them. American Education Week is an appropriate time to reexamine the educational program of your community. What is your school doing best? Can it do some things better? To help your school, you need to be well-informed about it." During the Week special effort will be made to get people acquainted with the schools; to give them the opportunity to be well-informed. This is an important activity, and it is none too soon to be giving thought to American Education Week.

ARBOR DAY IS DUE FOR REDEDICATION. J. Sterling Morton of Nebraska, Secretary of Agriculture from 1893 to 1897, crusaded for its establishment, and it is recognized by law in all States. During recent years it seems to have lost some of its early support. Harold Palmer Piser, insurance executive of P.O. Box 187, Flushing 52, New York, is chairman of an Arbor Day Association Committee, to renew interest in this observance. He will welcome recruits.

FROM DARMSTADT, GERMANY, comes a story of a boy of fourteen who shot down a pigeon and stamped on it. He was taken into juvenile court where the judge heard the details of the incident. The sentence pronounced was unique. The young offender was ordered to keep a parrot for twelve months and to teach it daily to say: "Never torture an animal." R.W.W.



The fate of the bee colony depends upon finding and harvesting suitable nectar that can be made into honey, the insect at the same time providing the vital service of pollination.

In their dance is found

The "Language" of the Bees

HONEYBEES have been kept in "captivity" for thousands of years. One would think that, by now, we would have learned nearly all there is to know about these astounding little creatures. Yet each time we solve a mystery of Nature we may find that a far greater mystery lies beyond. So it is with the honeybee.

There have been many books about bees, some of the best known combining good observation with fancy. Some forty-five years ago a noted scientist, studying the color sense of animals, asserted that bees were color-blind. This challenged Karl von Frisch, now Professor of Zoology at the University of Munich, to studies that proved that the scientist, not Nature, had erred. And in the years that have intervened this Bavarian naturalist has been drawn constantly back to the world of bees. These years of study have resulted in a fascinating new book, dealing with the vision, chemical senses, language and other details of bee life.

Beekeepers have always known that bees have some means of telling each other about choice locations of nectar. Every keeper of bees knows, also, that bees indulge in "dances," but it remained for von Frisch to determine the significance of these performances. These "dances," which anyone can observe through the walls of a glass-sided hive, consist of a sort of can-can in which the worker bee "dances" about over the comb, sometimes "waggling" its tail portion rapidly back and forth. The descriptive German term for this dance is *Schwänzeltänze*, literally translated as "tail-wagging dance."

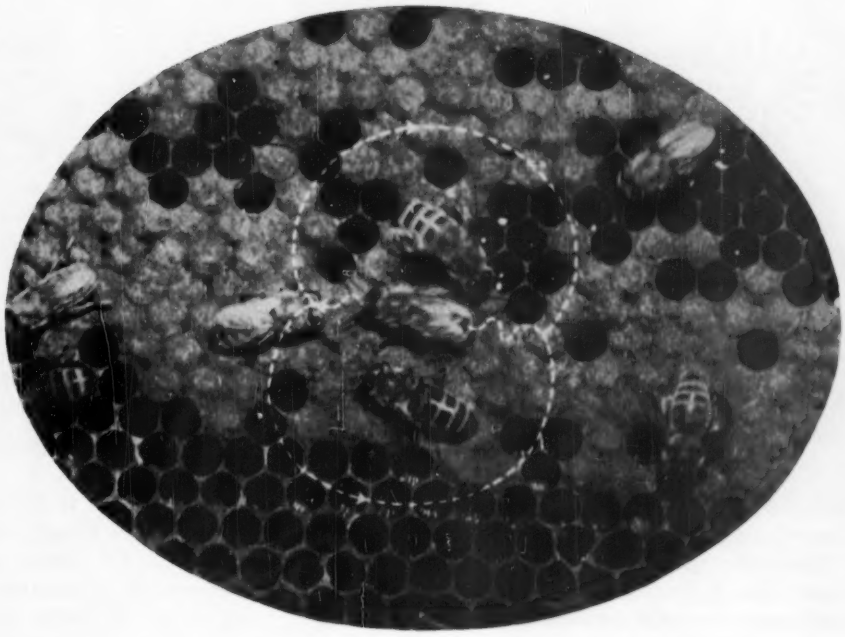
It was assumed that this "dance" had something to do with the bees having found a good source of nectar, but it was interpreted as merely meaning, "I have found nectar, go out and seek it."

We underestimated the bees. Actually these dancers were "telling" the precise direction in which the nectar was to be found, the distance to it, its abundance and the kind of flowers that held it. The dance is a little like the game of charades, in which a group of people attempt to guess the meaning of the silent pantomimes of another.

Karl von Frisch had long suspected that these "dances" had more precise significance than was commonly believed, but it required many years of work, and thousands of careful tests and experiments, before he was able to make any sense out of the mass of data that he and his students collected. When at last he published the results of his labors the scientific world was skeptical.

By ROSS E. HUTCHINS

Entomologist, Mississippi State Plant Board



A returning scout bee does her wagging dance in form of a figure eight, the central promenade indicating the direction with reference to the sun and gravity.

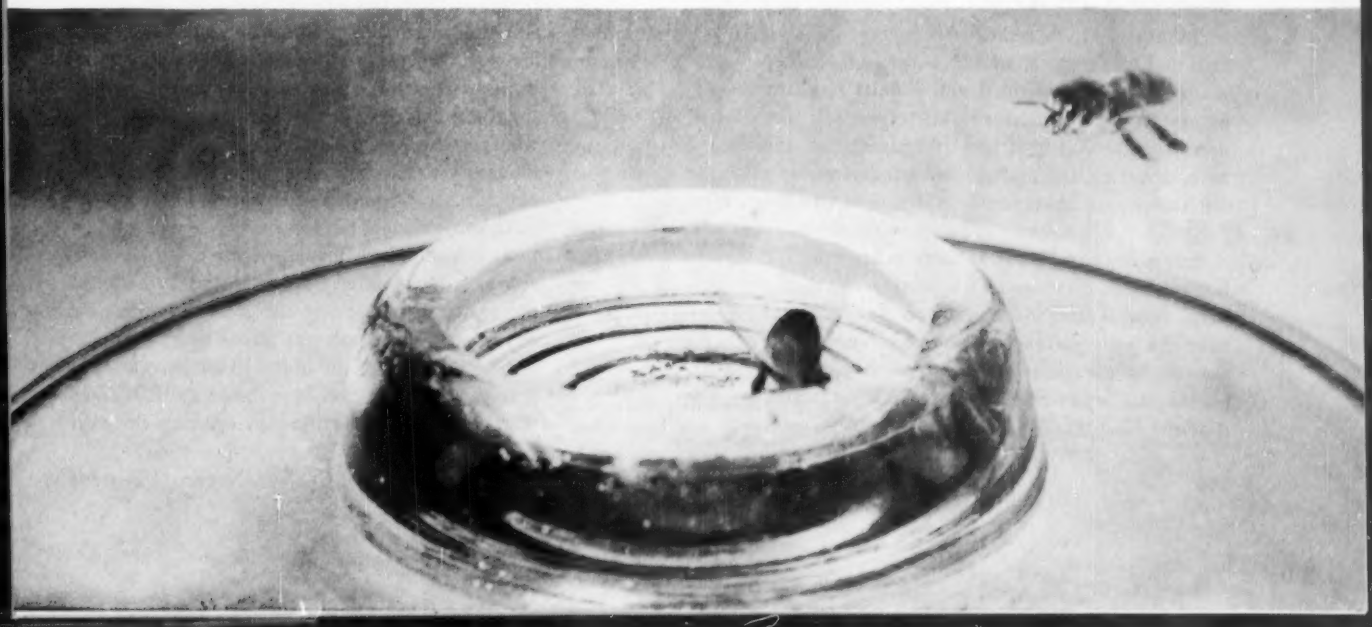
However, Dr. von Frisch was philosophical about the skepticism, saying: "No competent scientist *ought* to believe these things on first hearing." But truth can be proved, and independent confirmation has already been accomplished by workers in both Europe and the United States. Of course, there are still a few skeptics.

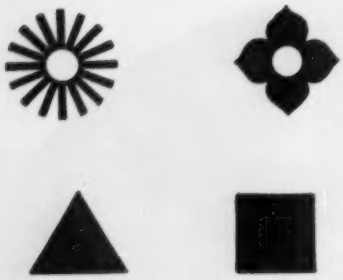
The methods devised by von Frisch to conduct his experiments have now become entomological classics. He used a glass-sided beehive, which allowed him to watch the bees going about their undisturbed, normal routine on the comb. Next he baited the bees with a saucer of honey, or sweetened water, placing this away from the glass hive. During the tests the bees were marked with colored paint so that each individual could easily be identified through the glass walls of the hive.

The saucer of food in place, Dr. von Frisch waited until a scouting bee located it and filled her honey stomach. She was then captured and marked with colored pigment so that her actions could be studied when she was back inside the hive. There the scientist observed the scout bee doing her waggle dance with a few of her sister bees following her. Soon other bees from the hive appeared at the saucer in the field, and returned to the hive. They, also, performed their *Schwänzeltänze*.

Gradually the "word" seemed to spread among the bees that there was a source of nectar. Soon all the inhabitants of the hive reached a state of great excitement, and there was a continual flow of bees out of the hive to the newly found food source. The returning bees waggle-danced about on the comb, just as the original scout bee had done. In time, however, the saucer of honey became empty; gradually the returning

To study the bee "language" small dishes of honey or other sweet were placed at varied locations to attract the scout bees. These bees were marked so that they could be observed when they returned to an observation hive.





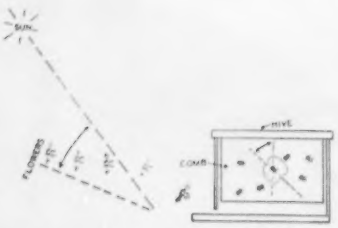
Honeybees can distinguish between the shapes of flowers, as in the two upper shapes. They cannot tell the difference between triangle and square, for what bee has ever met a triangular or square flower?

bees danced no more and the hive settled down again to its normal routine.

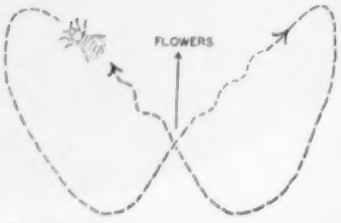
This little experiment had been done many times before, and the simplest explanation was that the dancing bees were merely indicating that there was a nectar source — somewhere. But Dr. von Frisch believed that there was more to the dance than met the eye. So he began placing his little saucers of scented sweets in various directions and at various distances from his glass-walled hive.

The naturalist made thousands of tests, checking and rechecking his results. Gradually a pattern appeared, and soon he realized that he had at least had a glimpse at an amazing discovery in animal behavior. He determined that when a scouting bee discovers a nectar source, whether it be a saucer of honey or a field of flowers, she returns to the hive and goes into her "dance." But this interesting performance follows a definite pattern or path; it indicates both direction and distance. Von Frisch found that the scout bees communicated their message by a typical figure-eight dance if the food was more than 100 yards away. The waggle run that formed the "waist" of the figure eight indicated the direction. If the nectar source was less than 100 yards from the hive, direction and distance were indicated by a different dance that von Frisch calls a "round dance."

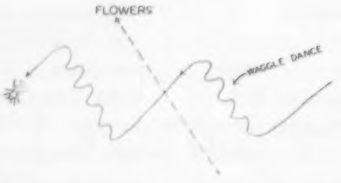
Bees may range as far as three miles from the home hive in their search for nectar. Watching the dances of farther-ranging bees, it was found that the more distant the source of supply the slower the gyrations in the hive. A dance repeated ten times in fifteen seconds indicated that the food was from 100 to 200 yards away.



The honeybee's eyes are so constructed that the bee can "fix" the angle of the sun with respect to the direction of food. In the dark of the hive the bee substitutes gravity for the sun.

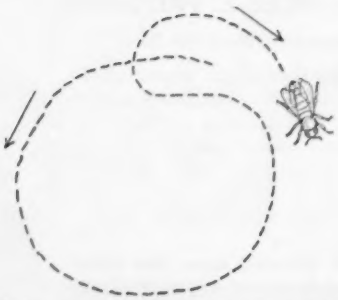


The circular type of dance gradually changes to the figure eight as distance to food increases. It is here shown to be fifteen to twenty-five yards away. The direction is also indicated.



If the scout bee has found a good source of nectar at only six and one-half feet from the hive she makes short, tail-wagging runs on the comb in the direction in which the nectar is located.

The alarm dance is easily observed in the bee hive.



This round dance is performed when the food supply is about eleven yards from the hive. The types of waggle dances change as the distance of the hive from the source of food is gradually increased.

If the performance was slowed down to four or five times in fifteen seconds, the source was 1000 yards away. Far distant nectar was signalled by quite slow dancing. Thus was distance explained to fellow bees.

The direction of the food supply was "told" by the direction of the wagging runs made by the bees as they did the figure of the dance. This indicated the angle of the sun with relation to the source of supply, the bees receiving the message while following the dance of the scout bee. Even within the dark hive the insects were not foiled. They used gravity on the upright comb surfaces instead of the directions given by the dance on horizontal surfaces. An upward wagging run indicated that the food lay in the direction of the sun, a downward run the opposite. The angle of the runs showed the angle of degree with relation to the sun. Bees have a delicate sense of feeling for gravity and can transform it into a bearing on the sun when they are outside the hive.

With these clues the bees can fare forth. They have smelled the sample of the sweet brought in by the scout bee. From this they learn the flower that yields it. They have been told how far they must go, and in what direction. Certainly this is the most amazing interpretive dancing.

Thus von Frisch solved the riddle of the bee's built-in compass. But he sought to probe more secrets. He wanted to see if the bees could orientate themselves on the comb with respect to the sun if the comb was placed in a horizontal position instead of the normal vertical one. He placed his observation hive inside a small, completely dark hut that had an opening through

The Dancing Bees is the title of the fascinating book reporting on forty-five years of the study of bees and their habits by Karl von Frisch and his associates. Written in popular terms, it not only describes the amazing discoveries of the ways in which bees communicate, but the book also describes the lives of these insects, their intelligence, senses and behavior. The accompanying article indicates the scope of the book and the fascinating subject with which it is concerned. The publishers are Harcourt, Brace and Company, and the price of this interesting book is four dollars.

Karl von Frisch is Professor of Zoology at the University at Munich, and a pioneer in study of the habits of bees.

which the bees could enter and leave at will. The comb was placed in a horizontal position and the bees were then observed by dim red light, which they cannot see. The bees continued to dance, but they could no longer orient their dances relative to gravity, on a horizontal surface. The insects leaving in search of food became thoroughly confused and searched in all directions.

Dr. von Frisch next made an opening in the wall of the dark hut allowing the bees to see a tiny patch of sky, but not the sun itself. He was amazed to find that when the tiny patch of blue sky became visible to the bees the dances were instantly orientated with the sun and pointed directly toward the source of food.

Another experiment relates to our modern 3-D. When you look at 3-D movies you wear special glasses, which polarize the light, or filter out all the light except that vibrating in one plane. If you happen to have a pair of these glasses about the house you can easily perform a little experiment that will show how von Frisch's bees were able to determine the position of the unseen sun.

Go out in your back yard on a clear day and hold your 3-D spectacles at a 45-degree angle. Watch the sky as you turn all the way around the horizon. You will be surprised to see that the sky, as seen through the spectacles, turns very dark at right angles to the position of the sun. So here we have a clue to the means by which the bees can determine direction by seeing only a small patch of sky. Evidently they have built-in 3-D glasses!

So Dr. von Frisch played a prank on the bees in the darkened hut. Outside of the tiny opening through which they could see only a patch of northern sky he mounted a mirror that reflected a patch of *southern* sky. The bees were completely fooled by this trick. Instead of going to the nectar source to the west, they flew to the east in a fruitless search.

Now, von Frisch asked himself, how does one part of the blue sky differ from any other part? At night, of course, there are stars by which celestial navigation may be achieved provided the necessary instruments are available. But in the daytime there are no stars visible. Perhaps the honeybees possessed eyes that could distinguish the polarization of light. This hardly seemed possible but in research every lead must be investigated.

To test this possibility the scientist next placed a sheet of polaroid over the opening to the hut and rotated it about while watching the reactions of his dancing bees. *This was the answer.* The bees could be made to search in any direction simply by rotating the sheet of polaroid. Other researchers recently found that ants, also, travel by orientating themselves by polarized light.

Further studies of bee navigation showed that the bees could not orientate themselves if the sky was completely overcast. They had to see at least a patch of blue sky to find their way to the source of food.

These are some of the secrets of the hive that this German scientist has discovered through long and painstaking experiment and observation. Others relate to life within the hive; to the bee's smell and taste; to the formation of its eye and how it works; to the importance of color to the insect; to its sense of time and its mental capacity. The stories of these studies, and the conclusions to which they have led, are told, popularly and in detail, in Dr. Karl von Frisch's *The Dancing Bees.* They cannot really be briefly described, but have been suggested here as an indication of the fascination that lies in the complete story in his book.

NIGHT BLOOMING FLOWER

Lift up your cup, to catch the dew,
Your petals spread to lure the moon.
We wait elate, to welcome you,
For night and beauty pass so soon.

Lalia Mitchell Thornton

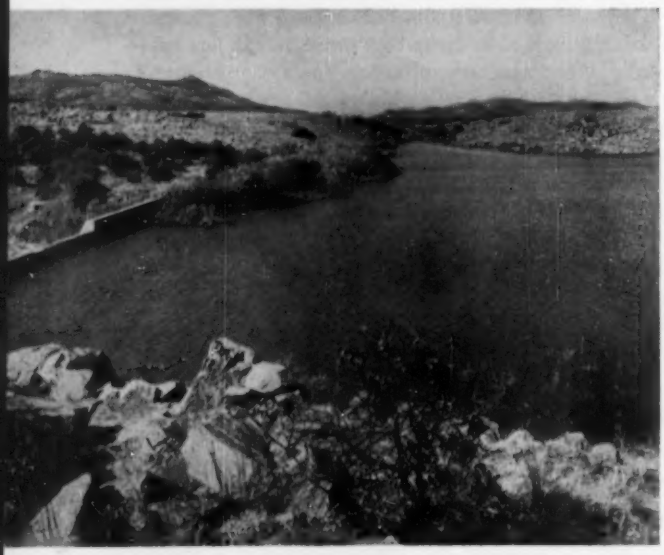
Wichita Mountains Wildlife Refuge in Peril

View of Wichita Mountains National Wildlife Refuge as seen from the top of Mt. Scott, highest peak in the Wichitas. An excellent paved highway encircles this peak and leads to this observation point.

It was with the hope of finding the rock sparrow and rock and canyon wrens—that my husband and I started up the slope in Elk Mountain in Wichita Mountains National Wildlife Refuge, Oklahoma, on the morning of April 12, 1955. Between the great granite boulders strewn down the mountain side, little flowers were blooming—a miniature blue violet, a midget cress and a tiny bright pink verbena, as well as beds of spring beauty. A cardinal sang lustily by the clear tumbling brook, tufted tits called, and the lovely lay of the mourning dove floated down from above us. Butterflies flitted from flower to flower. Turkey vultures sailed overhead. A deer looked down at us, then vanished.

All at once we heard a nasal *pur-pur-pur*, loud and shrill, then a chatter something like the rattle of a kingfisher. Presently, under the shadow of a boulder, we noticed a rock sparrow, a bird found only in wild, rocky places in western Oklahoma and Texas, and in Mexico. A series of grating, varied and strange speechifyings came from a rock wren. After a few vehement phrases from the top of a boulder he would quickly pop into a crevice. In striking contrast to these two birds, with their harsh and curious vocalizations, were the wild and lovely notes of the canyon wren, which found their perfect setting in the rugged beauty of these Wichita canyons.

Caddo Lake is one of the lakes created on the Refuge.



We should have been completely happy, that morning on Elk Mountain, but a great fear oppressed us. We knew that the unique Wichita Mountains Wildlife Refuge is gravely threatened. The United States Army wants an important part of it for an artillery and guided missile center.

Twelve days later we returned, this time to meet with the Oklahoma Ornithological Society, a group of 300 people keenly interested in Nature. All the trees now had leaves of shimmering green. Again we camped at Sunset Pool at the base of Elk Mountain, there to hear the strange calls of chuck-will's widows, and the melodious songs of the summer tanager. Crested flycatchers whooped and hollered and red-bellied woodpeckers loudly complained.

Again we climbed the slope of the mountain. Here was majesty, and here was peace. Three deer sprang up a few yards away. A cottontail scampered off. Different flowers greeted us.

It was in the Wichitas that we first camped, 35 years ago, when we undertook the study of the birds of Oklahoma. Many times in the following years we camped in the Wichitas, always finding new delights, new treasures—among them, painted buntings, black-capped

By MARGARET MORSE NICE

Photographs by E. P. Haddon from U. S. Fish and Wildlife Service

The Army Public Works Bill now before Congress seeks authorization to purchase 20,000 acres of private lands outside Wichita Mountains Wildlife Refuge and to take 10,700 acres from the Refuge. This acreage would be used for artillery range. The demand is typical of many that arise these days—demands that ignore the special purposes for which parks, forests, refuges and similar areas were set aside.

Aerial view of Quanah Parker Lake, one of the many artificial lakes on the Refuge. These lakes provide excellent fishing, and camping and picnic grounds are found near most of the Refuge lakes.

vireos, nesting red-tailed hawks, and brilliant summer flowers.

The Wichita Mountains were the ancestral home of the Wichita Indians. Generals McClelland, Winfield Scott and Phil Sheridan of Civil War fame fought here against bands of Kiowas and Comanches. Quanah Parker, last chief of the Comanches, lived in these mountains. He is buried just south of the refuge, and a lake bears his name.

In 1905 an area approximately 9 miles wide by 15 long, comprising 59,099 acres, was set aside by Theodore Roosevelt as a National Forest. Thirty years later it was transferred to the Fish and Wildlife Service. At the time of the forest's establishment grave fears were felt for the future of the buffalo. Congress appropriated $15,000 for an 8000-acre enclosure, and, in 1907, 15 buffaloes, donated by the American Bison Society, were turned loose in their new home. They throve and multiplied. The rest of the preserve was badly over-grazed by domestic cattle, until their exclusion in 1937. Under wise care and moderate grazing the prairie grasses are now flourishing; indeed, the refuge is the largest area of natural bluestem range left in the United States.

This April, Ernest Greenwalt, Refuge Manager, drove us over the preserve and told us many things. Buffaloes were met here and there all over the pastures, usually in bands, occasionally an old bull by himself. A few brownish-red calves were frisking about, waving their little tails, while one was trying its best to roll over. The herd now numbers about a thousand.

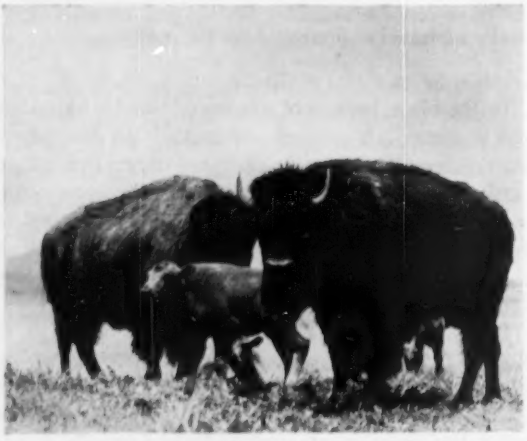
The other most conspicuous animal on the refuge is the Texas longhorn. Some are solid white, black, red or yellowish, while others are spotted in a variety of patterns. They are descendants of the Spanish cattle brought to Mexico in 1521 by Gregario de Villabolos. Coronado brought them north while searching for the fabulous Seven Cities of Cibola.

By the 1920s, because of mixture of blood with English and Brahman cattle, longhorns had all but disappeared. Two Forest Service men examined more than 30,000 cattle on a 5000-mile trip in order to find the twenty cows, four calves, three bulls and three steers that started the Wichita herd in 1927. There are now 350 of them, including 80 steers with horns more than seven feet long. This is the largest herd in existence.

By 1875 the native elk had been exterminated in the Wichitas. The present herd of 200 are from 17 animals brought from Jackson Hole, Wyoming. They keep largely to the hills and mountains. The native white-tailed deer, most abundant of the large mammals, number

Postoak Lake surrounded by giant outcroppings of granite.

The only large herd of longhorn steers is now found on Wichita Mountains Refuge.



Bison herds on the Refuge have prospered on the 8000-acre enclosure that has been provided for them.

about 1300. A few antelopes were introduced in 1938, but the habitat apparently does not suit them too well. At present there are 21 on the refuge.

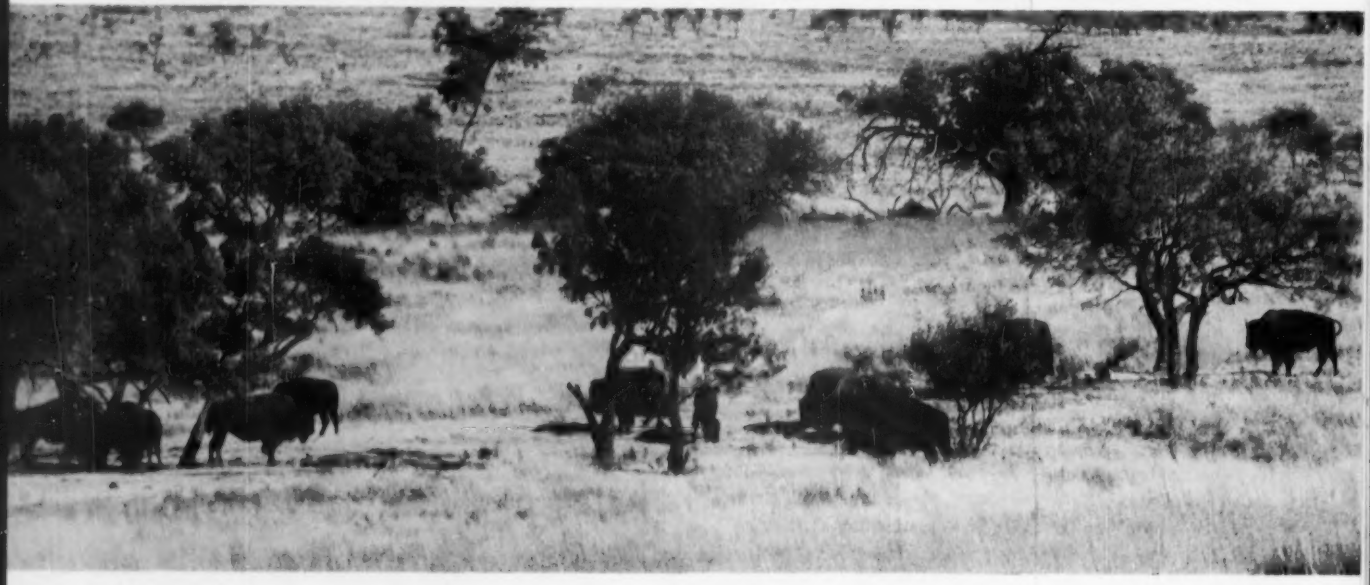
Another persecuted mammal, now unfortunately rare, has found a refuge in the Wichitas—the prairie dog. They sit on their mounds in their town on both sides of the scenic highway; bark and flirt their tails, and run and pop into and out of their holes.

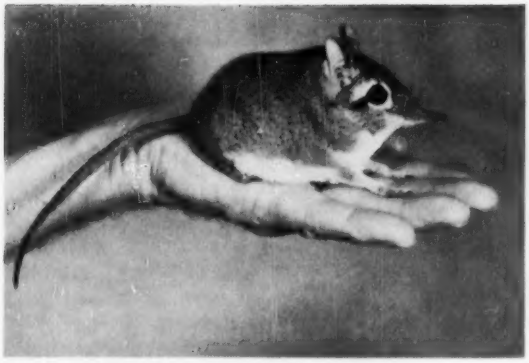
Wild turkeys strut and gobble in the groves, flying into the great post oaks to roost at dusk. Migrating ducks are common on the many lakes, mallards being particularly abundant when the acorn crop is heavy. Some winters robins form large roosts in the red cedar groves. Golden and bald eagles winter, and turkey vultures nest in the rugged mountains.

The Wichita Refuge constitutes by far the finest natural area in Oklahoma, and for hundreds of miles in all directions. People come from Oklahoma and Texas, and from far away, to camp, swim, fish, and enjoy Nature. It is the site of many outdoor gatherings. Girl and Boy Scouts run summer camps at Camp Boulder. Ten to fifteen thousand visitors may visit the area on the Fourth of July and Labor Day. From thirty-two to fifty thousand spectators gather each year for the impressive Easter pageant at the foot of Mount Scott. During 1954, nearly eight-hundred thousand people visited the Refuge.

Fascinating as is the splendid larger wildlife, to many it is the ancient, jumbled, fantastically weathered mountains, their cedars, blackjacks and large-toothed maples, their little flowers, their rock sparrows and rock and canyon wrens, that make the whole refuge priceless. *And it is the finest of these mountains that the Army wants to take over and destroy.*

The Artillery School at Fort Sill wants $2,320,000 to purchase 20,320 acres of privately owned land south of the Refuge. This comprises homes and ranches, as well as Craterville Park, a popular (*continued on page 331*)

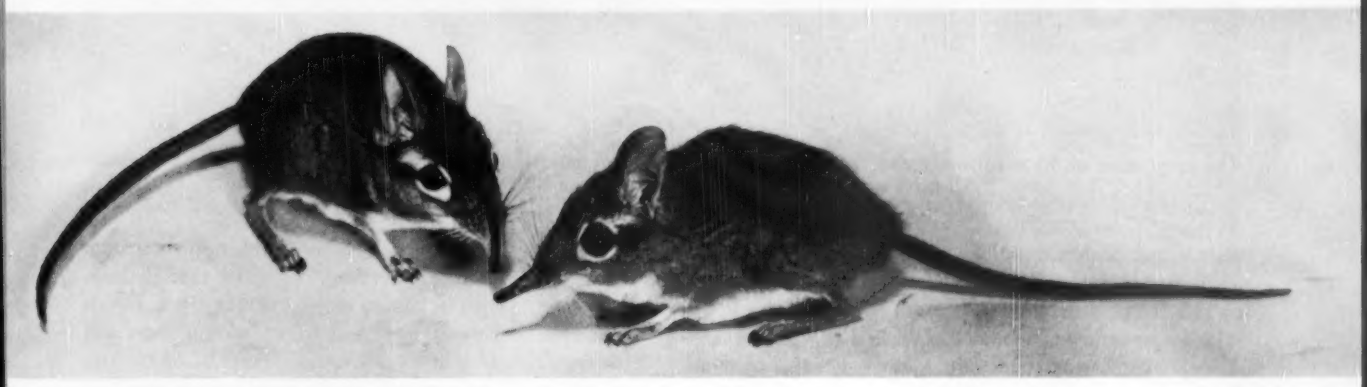


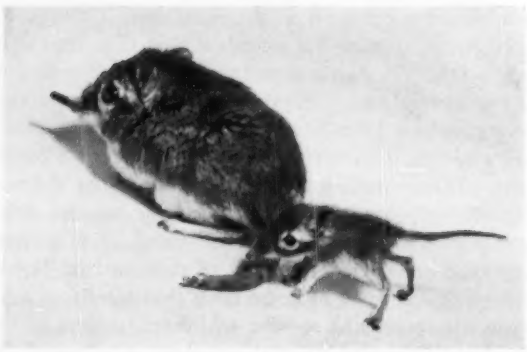


African Elephant Shrews

By ERNEST P. WALKER

Assistant Director, National Zoological Park





Mother and child, the latter believed to have been less than three days old when photographed.

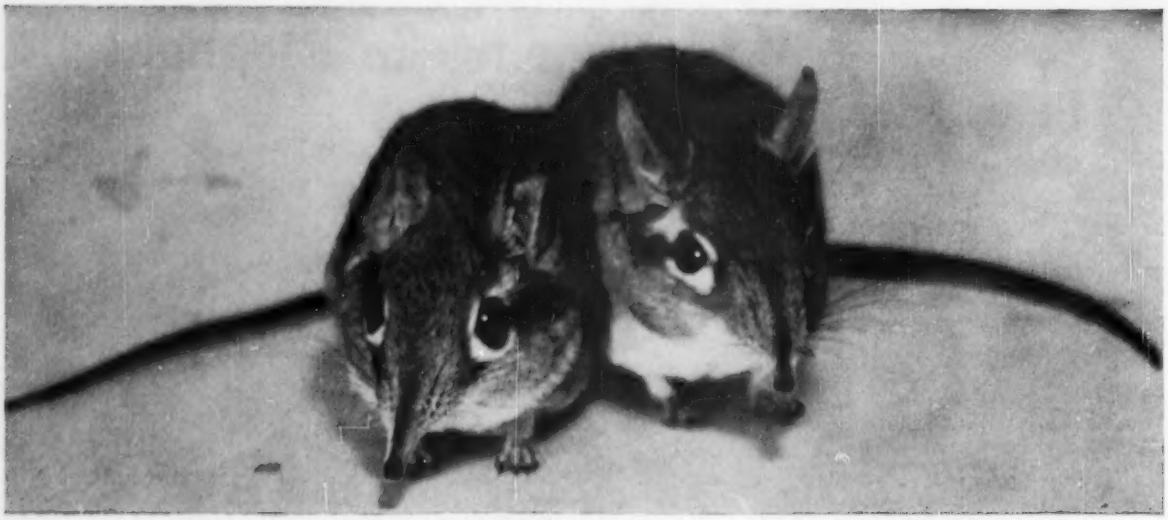
The male shrew soon came to take meal worms from the fingers of the author.

IN AN effort to solve some of the problems of raising elephant shrews, *Elephantulus rufescens*, of Africa, I kept some in my home for close observation. They proved to be fascinating subjects and pleasing pets.

These lovely creatures bear no resemblance to the popular Shakesperean idea of a shrew, and but little resemblance to the true shrews.

Several different forms of elephant shrews, and their close relatives, inhabit much of Africa south of the Sahara. Some are of such extremely slender build, and with such long legs that they are not particularly attractive, but mine are truly beautiful. The coloration above is a soft brownish-gray, and the underparts are an immaculate white with a suggestion of cream color. The furry coat is soft and of fine texture. The length from the tip of the nose to the base of the tail is four to six inches, and the tail is three and one half to five inches long. The adults weigh from about two to four ounces, the males being definitely larger than the females. There are other species both larger and smaller. The tail is almost naked and ringed with scales like the tails of the true mice and rats. While the legs are long and slender, they are strong. On the hind foot there are four well-developed toes, with one very small one high up on the inside of the foot, and there are only four toes on the front feet.

The general appearance and coloration constantly reminded me of medium-size kangaroo rats. But, of course, their long noses, from which they get their vernacular name "elephant," break such similarity and



The long noses of the elephant shrews seemed to be in a state of perpetual motion and to indicate a keen sense of smell. All food was examined by the flexible nose before it was sampled.

they stand higher on all four legs and run much more than they hop, although they can make quick long leaps.

The long noses were in a state of almost perpetual motion, twisting about until they outlined the form of a somewhat flaring cone. No doubt their sense of smell is very keen. It was amusing to see how carefully they examined all food with the flexible nose before sampling it.

They were timid, and handling must be gently and quietly done. They showed no evidence of being savage biters, although I was nipped lightly a few times.

The male soon came to take meal worms from my fingers and he did not object seriously to my handling him gently. The females were more timid and scurried about to avoid being captured, and would leap out of my hand if the slightest opportunity presented.

On one occasion a female landed on the floor and slipped behind a filing case. I reached after her but could just barely touch her rear end. She then backed into my hand, apparently realizing that the hand was friendly and perhaps did not offer as much danger as the terrible unknown world outside the cage.

I was never able to determine whether these animals were nocturnal or diurnal, for they seemed to be awake and alert at all times of the day and night. In fact, I never saw them asleep in a relaxed pose. They stayed out of the nest box about equally by night and day, and I never saw them with their eyes closed for longer than a mere blink. Their constantly alert way is suggestive of the cottontail rabbit.

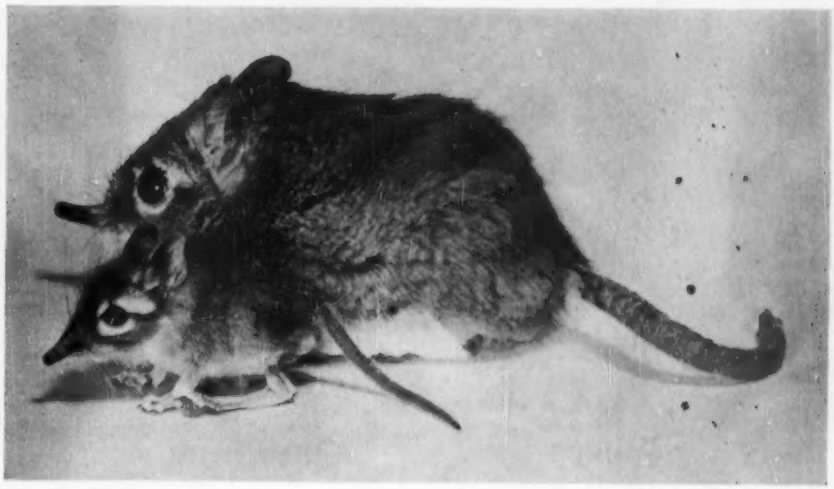
My observations concerned a male, two females and one baby, born to one of the females. The male was definitely dominant, usually choosing the top of the nest box, or a platform in the cage that gave him the best possible view of the surroundings. Sometimes a female would sit along-side him, but most of the time she would be in a less conspicuous situation, such as a corner of the cage, or would take refuge safely in the nest box.

When the male saw or heard what he thought was dangerous, he gave an alarm by stamping one of his hind feet. Serious danger called for vigorous and rapid tapping, almost like a snare drum. The rate of tapping would be abruptly varied, and so would the strength of the stroke. After the initial alarm of several seconds of rapid, hard tapping, it might slow down and become more gentle. For several seconds it might continue with only a thump or two a second. If the danger seemed to be past it would stop, but if it was renewed the stacatto drumming was resumed. Often the drumming sounded like a telegraph instrument receiving a message in Morse code. The drumming was done on the top of the nest box, the plywood bottom of the cage covered with newspapers, the disc of an exercise wheel, or on a sheet-iron shelf in the cage. On any of these surfaces it was so loud that it could be heard more than forty feet, even when the sound had to take a U-shaped course in the apartment through parts of three rooms and a small hall. In the open, on dry wood or leaves, it could probably be heard by average human ears for fifty feet or more.

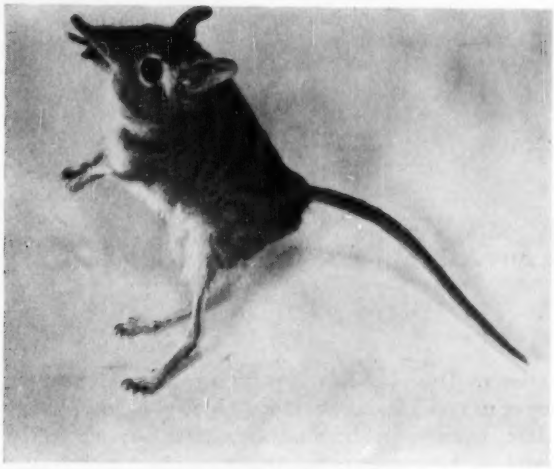
Often it appeared that the male was unnecessarily diligent in giving the alarm to send the females to the nest box and keep them there. He frequently looked as though he might be an arrogant dictator, insisting that they remain under cover even when no danger threatened. He frequently gave an alarm when he saw them start to venture out of the nest box.

Other than warning the females to take cover he always seemed to be kind to them. One female had the tip of her tail chewed, but we could never determine whether he did it or she did it herself, as sometimes occurs among captive animals.

Plenty of nest material was supplied the creatures, but they never made any use of it. On the contrary, they often pulled or pushed it out of the nest box.



Mother and youngster, which latter weighed one-quarter ounce and seventy-five grains on the day on which it was found. Below, a shrew stands on its hind legs to investigate food, slightly suggesting the kangaroo rat.



"What shall we feed them?" was the question asked of me when a considerable shipment of these elephant shrews was received by a Government agency for experimental studies. I made some suggestions, then almost immediately had this problem to solve for elephant shrews of my own. Fortunately my suggestions had been good, and, still more fortunately, these shrews do well in captivity if given a considerable variety of food. I found that they ate meat, meal-worms, insects, hard-boiled eggs, cottage cheese, nut meats and small amounts of such fruits as grapes, oranges, bananas, apples, and some green material as lettuce, clover, cabbage, and the like. They took no interest in earthworms, perhaps because they were too well satisfied with other food that they preferred.

The fortified food mixture I had developed for my captive bats was relished by the elephant shrews to such an extent that they frequently neglected other foods. This food mixture has been so successful with many small creatures that we repeat it here.

One yolk of hard-boiled egg, approximately an equal amount of rather dry cottage cheese; approximately an equal amount of ripe banana; approximately an equal amount of meal-worms. Six drops of jeculin. Six drops of wheat germ oil. Three grains of Theragran.

Make up the mixture with a mortar and pestle. If the wheat germ oil is in 3 minim capsules put in two, also add the Theragran, which is a yellowish paste. Add a few drops of water to soften the gelatin of the wheat germ oil capsules and to dissolve the Theragran. Then put in the other ingredients and grind all together with the pestle until a paste is formed with the chitin of the worms scattered through it.

If biological research workers found elephant shrews suitable for any of their studies they would at once want to know how to breed the shrews in captivity so that a constant and adequate supply of healthy animals might be available. We were therefore particularly hoping that we could provide conditions that would induce them to breed and rear young.

After having had a pair, or three, for nearly two years, I had given up all hope of seeing baby elephant shrews. Then I found a single young one in the cage. It was almost a miniature of the parents, but the fur was of the slightly woolly texture so often characteristic of baby mammals, and with a sprinkling of much longer wavy hairs. It was surprisingly large and moving about, although a bit wobbly. I had handled the mother and looked in the nest box only three days before and there was no baby, so it must have been less than three days old. I believe it was only a few hours old.

The weight of the little one on the day I found it was one-quarter ounce and 75 grains. Seven days later it weighed three-quarters ounce and six grains. Without apparent evidence of ill health or accident it died suddenly when three weeks old. At this time it weighed three-quarter ounce and 86 grains. Its failure to gain weight at a good rate after the first week suggests that it probably was not being adequately nursed by the mother, or that it suffered from some internal defect.

During the first day when the baby left the next box and went into the cage the mother picked it up and carried it back into the box. The next day she did this twice, then apparently she con- (*continued on page* 332)

Ashanti gold weights from West Africa, showing two kinds of African hornbills in miniature castings. The perching bird has the casque of a black hornbill, while the one fighting a snake appears to be a ground hornbill.

Those funny looking birds,

THE HORNBILLS

New Ireland dance sticks, carved to represent the heads of wreathed hornbills. The eyes are made from the green opercula of snails.

"THAT SURE IS a funny looking bird!" exclaimed my son Steve, as he leaned over the top of my desk to see the old engraving there.

"It's one of the hornbills," I explained, not surprised at his reaction, for "funny looking" was an apt description.

Hornbills are such strange creatures that they always make a deep impression. There are none native to this country; we see them only in zoos and museums, and even there one can see only a few of the many species. There are more than sixty varieties in Africa, India, southeast Asia, and some of the Pacific islands.

Most of the hornbills are rather large birds. The giant Homrai hornbill of India and southeastern Asia often measures four feet, while the smallest, found in Africa, is only about the size of a bluejay. Some of the features that most of them share in common are long, prominent eyelashes, ridiculously large beaks, and jutting casques on the front of their heads.

The hornbill's casque is one of its most distinguishing features. This is a horny projection growing up from the top of its upper beak, resembling a kind of helmet by that name, worn by soldiers in olden times. Some of the hornbills have an extremely large casque; on others it can barely be seen; a few lack it entirely. The casque, on all but one hornbill species, is hollow or filled with a spongy bone tissue. The bird's head is, therefore, not too heavy when it flies.

Men have found uses for the hollow casques of the larger hornbills. For example, old Chinese books say that long ago their neighbors in Indo-China used the large casques of the Homrai species for drinking cups.

The helmeted hornbill here shown has a heavy casque, a solid lump of a yellowish, ivory-like substance, covered by an arching layer of brilliant scarlet, and with the color and consistency of a painted toenail.

The peoples of many nations formerly carved "hornbill ivory," especially the Chinese, and they found uses for the red casing as well. In fact, the Chinese developed a secret method for flattening out the casques to afford larger pieces to work on, and, in the process, the red layer was fastened more firmly to the base material so that it became one with it.

The helmeted hornbill apparently never lived in China. At present it is found in Malaya, Borneo and Sumatra. Probably man first learned to use its ivory in Sumatra. Old Chinese books speak of quite an industry there, one

By SCHUYLER CAMMANN

Photographs by Reuben Goldberg, from objects in the University Museum, Philadelphia

Carved wooden figure of a rhinoceros hornbill from Sarawak, the casque typically exaggerated.

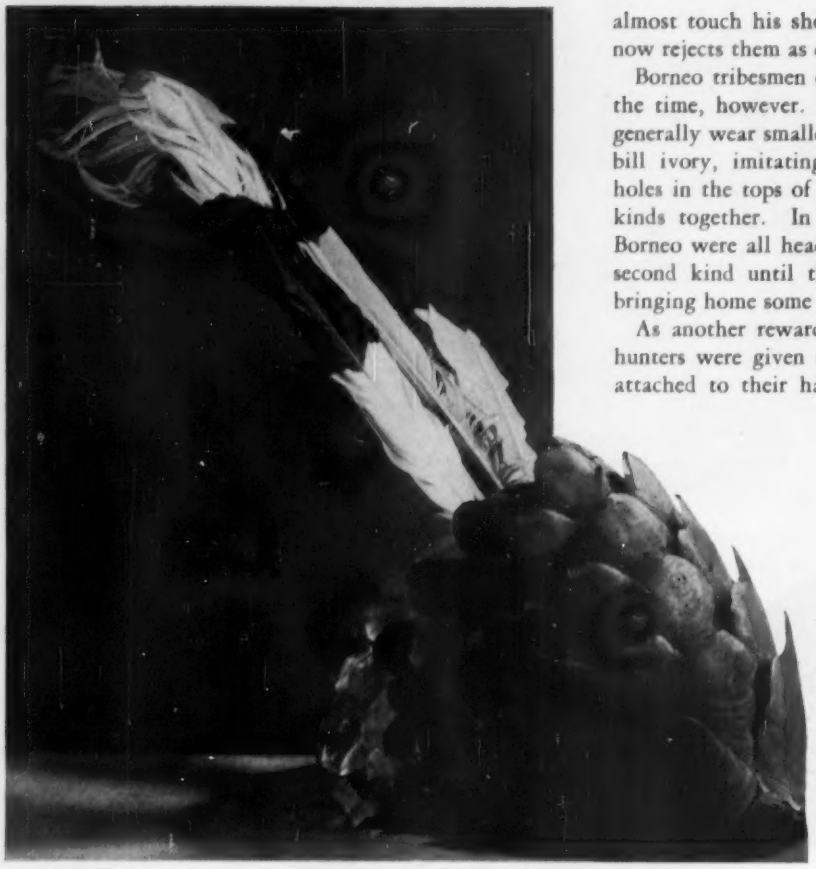
Chinese carved skull of a helmeted hornbill, showing a traditional historical scene.

An early nineteenth century engraving of a helmeted hornbill, the first picture of a complete example to reach Europe.

especially noted for producing finely carved sword hilts.

The first Ming Emperor of China received some helmeted hornbill casques in tribute from the Sultan of Brunei, Borneo, in 1371. Later Chinese traders went south in their own junks to buy more. They were willing to give much money for pieces of hornbill ivory, because the courtiers in Peking had developed a desire for its beautiful red surface. Carved combs and belt ornaments with red facings were particularly prized at the court. Red was the Ming dynastic color, and in China it has

Sepik River wooden pillow from New Guinea, the ends carved to represent a wreathed hornbill and a cassowary.



Borneo headhunter's war-hat, made from the scaly skin of a pangolin, with feathers of the rhinoceros hornbill. This was a reward for successful raiding.

always been the color that signifies joy and gladness.

The industry that began in Ming China lasted in the two main centers of Peking and Canton until the beginning of the present century.

The art of carving horn bill ivory was so quickly forgotten that ten years ago Chinese merchants no longer recognized things made of it. In the meantime, Japanese also learned to carve it, when they could get it. But it was a great rarity there, and Japanese examples are now seldom seen.

Malayans used to make rings and spoons out of hornbill ivory, believing that these could detect poison in food or drink. From there, the idea of its magical properties spread to other Mohammedan countries, notably Persia and Turkey. Recently, in the old palace of the Sultans in Istanbul, I found thirteen spoons, four archer's thumb rings, and a handsome sword hilt, all made of hornbill ivory.

Hornbill ivory is still carved in northern Borneo, where the Chinese first found it. Some of the older tribesmen there still make and wear huge earrings, carved out of the whole casque, with part of the upper beak worked into a hook with which to hang them. Such earrings often pull down a man's earlobes until they almost touch his shoulders, so the younger generation now rejects them as disfiguring.

Borneo tribesmen do not use these heavy earrings all the time, however. For ordinary occasions the elders generally wear smaller, carrot-shaped ear plugs of hornbill ivory, imitating leopard's teeth, thrust through holes in the tops of their ears. They never wear both kinds together. In the days when the wild men of Borneo were all headhunters, they could not wear this second kind until they had proved their prowess by bringing home some enemy heads.

As another reward for bravery, the successful headhunters were given the right to wear hornbill plumes attached to their hats, or on the backs of their war jackets. Men of chief's rank used the three-foot, middle tail plumes of the helmeted hornbill, mostly white with a band of russet brown near their ends. Other warriors generally wore the shorter and broader tail feathers of the rhinoceros hornbill. These were white with a broader band of black. Every long plume was supposed to represent a slain enemy, and these are still worn for ceremonial dances.

It was not always necessary to kill the helmeted hornbills to get their rare, middle tail plumes. Oddly enough, this bird grows these two long plumes alternately. When one grows out, he sheds the other, and begins to sprout a new one. The natives sometimes come across a cast-off plume in the jungle.

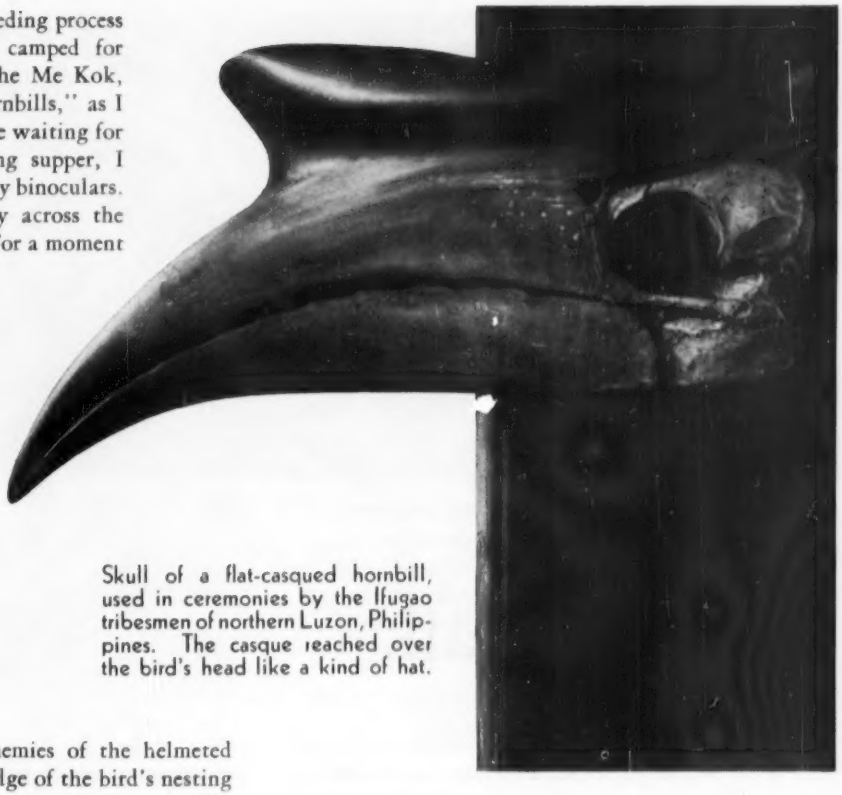
It is true, as Steve pointed out to me, that the engraving shows two long tail plumes, and several others only a little shorter; but it is not entirely accurate. The artist drew it more than one hundred years ago, from a captive bird that may have been moulting, and, in improving upon Nature, he has given him too much tail altogether.

The alternation of its long tail plumes is only one of the many peculiarities of this peculiar bird. Another is its strange habit of nesting, although it shares this trait with most of the other hornbills.

The male bird helps his mate to hollow out a hole in the trunk of a tall tree. Then he plasters her in with mud or tree gum, leaving only a small hole for her to stick out her beak when he brings her food. He supplies her with fruit at intervals, as long as she remains in the nest. First he swallows the fruit himself, while plundering some wild fruit tree. Then he flies back and casts it up for her in a sack composed of the lining of his gizzard. It is easy to see why the peoples of Burma celebrated the hornbills in song and legend as models of marital devotion.

I once happened to see this feeding process in northern Siam. We were camped for the night along the bank of the Me Kok, which means "River of the Hornbills," as I discovered later. While we were waiting for the boatmen to finish preparing supper, I followed a flying Homrai with my binoculars. He flapped his way laboriously across the river at a considerable height. For a moment I lost sight of him. Then I spotted him again, perched on a branch beside the trunk of a giant tree. Beside him was the beak of another bird, that of an imprisoned female.

The mother hornbill stays cooped up in the tree until the young are grown enough to fly. This is for her own protection as well as theirs, for during the nesting period she moults all her feathers, and, like her young, she must grow a complete new set.



Skull of a flat-casqued hornbill, used in ceremonies by the Ifugao tribesmen of northern Luzon, Philippines. The casque reached over the bird's head like a kind of hat.

Unfortunately, the human enemies of the helmeted hornbill have used their knowledge of the bird's nesting habits to gain the valued casques and plumes. The Punan tribesmen of back country Borneo keep watch on the male of the helmeted hornbill pair, tracking him closely to see where he goes. When he has unknowingly led them to the nesting tree and is busy feeding his mate, they shoot him with blowguns. Then they fell the tree and open the nest, to get at the rest of the family. Taking the mother bird's casque, her plumes in the nesting condition being useless, they also bring home the young birds for food. This kind of hunting has almost exterminated the helmeted hornbill, so that it is now a rare bird.

Otherwise, the people of Borneo are fond of hornbills. They keep some of the smaller species as pets in their longhouses, and have a deep religious veneration for the large ones, particularly the rhinoceros hornbill. This species has less economic value than its helmeted relative, and lacks the long tail plumes, but his hollow casque is far more eye-catching. Vivid scarlet, orange, and lemon-yellow in color, its front end juts upward in a sweeping curve.

The more civilized peoples of Borneo make elaborate wooden figures of the rhinoceros hornbill to decorate their houses, or to use in special pagan rites. The artists almost always exaggerate the already grotesque-looking casque. They often show its front projection as a towering spiral. To them the casque was the most obvious and magical part of an awesome bird, so they felt they should emphasize it.

The actual casque of the rhinoceros hornbill is often kept in Borneo houses as a children's plaything. They are probably considered as more than toys, as actual magical means for strengthening the youngsters. For similar reasons, Malayan mothers used to give their children quills of the helmeted hornbill to suck on when they were little.

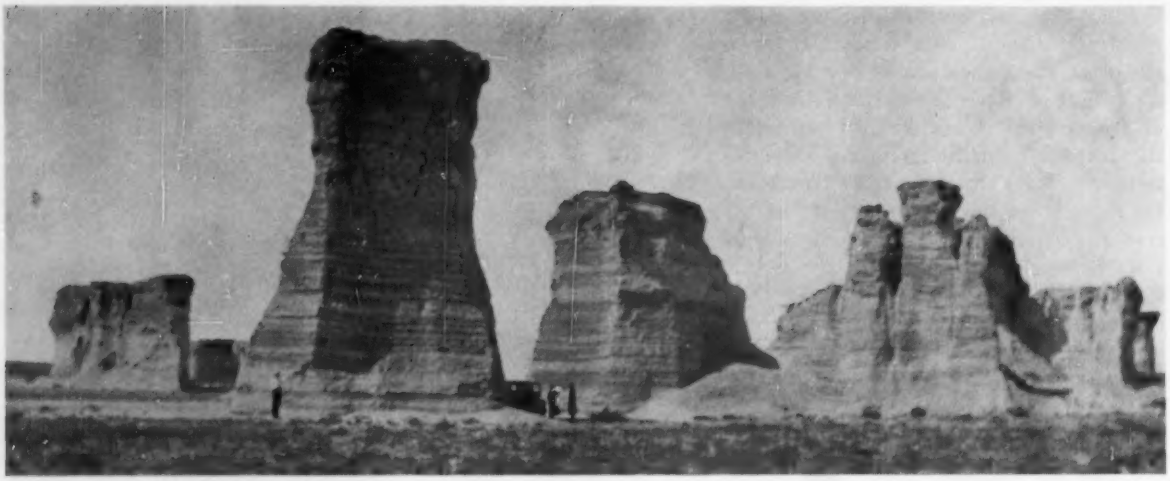
Borneo is a land of strange headgear, but the strangest hat I ever saw was in the Sarawak Museum there. It was a chieftain's cap, covered with cowrie shells. From the top jutted the complete head and neck of a rhinoceros hornbill, stuffed of course.

They never could have used a helmeted hornbill's head in this way, because it would not only be much heavier, but far too ugly. Many of the hornbills have patches around their eyes, or on their throats, totally devoid of feathers. The helmeted variety overdoes things, having a completely bare face as well.

The Chinese found a way to beautify these singularly ugly heads during the 19th century, and so made handsome ornaments from the whole skull by carving an elaborate scene on the front of the casque, to be framed by the arching red sheath. Then they usually covered the head bones at the rear with beautiful feathers from other birds, such as the peacock.

The plain skulls of another species, the flat-casqued hornbill, were used by the tribesmen in the Philippines for ritual magic. The Ifugao of northern Luzon brandished them during the harvest ceremonies, and they also set them up on poles to keep away evil spirits.

Other hornbills have strange casques. The wreathed hornbill of New Guinea, and neigh- (*continued on page* 332)



Monument rocks of chalk in Gove County, Kansas. This area is rich in fossil formations.

Kansas Chalk

By MARGARET WHITTEMORE

Contrary to popular belief, Kansas is not merely a flat prairie given over to winter wheat and sunflowers. Nature, for the sake of variety, has erected, in the western part of the State, chalky skyscrapers, as imposing in their way as the white cliffs of Dover along the coast of England. They are made up of the same basic substance.

The fantastic rock formations in Gove County, Kansas, are all that remain of the chalky shale that once filled the Smoky Hill Valley. They stand apart from each other as though built by human hands, instead of being, as they are, the result of erosion. A visitor might even imagine that these spires and pinnacles were ruins of an ancient city. On one of the rocks wind and rain have etched the profile of a human face. Its eyes watched expectantly for the coming of white settlers many centuries before man carved the Egyptian sphinx near the banks of the Nile.

Chalk has been aptly described as "the dried mud of an ancient sea." The deposits in Kansas had their origin hundreds of millions of years ago when oceanic inundations covered much of North America. Microscopic marine creatures of that cretaceous era left on the ocean bed their shells and skeletons, which, under the enormous pressure of sea water, became solidly packed together. The resulting limestone that we call chalk, uniformly dense in texture, was eventually uncovered by shifts in the earth's surface and by river erosion. As the water drained away, it left chalk beds and such bizarre monuments as these skyscrapers of the plains. Harder layers of rock sometimes form protective caps for the softer chalk underneath. Large shells and fossils of sea animals have been found on their peaks. At the summit of Castle Rock, highest of the group, are carved the initials of climbers.

Geologists have found the chalk beds of Kansas to be a fossil hunter's paradise. Exercising the patience and skill of real detectives in their search for clues, they have uncovered fossilized bones that indicate here the former existence of possibly the largest flying creatures the world has ever seen. These fish-eating reptiles, with wing spreads of twenty feet, bring to mind fairy stories of flying dragons and brave knights who rescued maidens from their clutches.

Almost as startling was the discovery of prehistoric lizards and crocodiles of gigantic proportions, eleven-foot turtles, wingless birds with teeth, immense thin-shelled oysters, and the world's largest insect—a primitive dragonfly. Chalk beds have produced evidences that during a later period miniature horses, eleven inches high at the shoulder, roamed the region in herds. No wonder the chalk deposits of western Kansas have become famous the world over!

It is fitting that this important geological substance is given a plug in the University of Kansas yell, the famous "Rock chalk, Jayhawk, K. U.," a rolling cadence, uttered twice and followed by three short staccato repetitions. Chalk is often referred to unofficially as the State Rock of Kansas, and is, in fact, a material that few other States can claim. Kansas deposits, ranging from sixty to eighty feet in thickness, form reserves estimated at fifty billion tons—a quantity sufficient to supply the entire United States for centuries. While chalk underlies much of the State, cropping out at the surface in nine or ten counties, it assumes by far its most picturesque forms in Gove County.

The Green Cell Yields a Secret

By IDA SMITH

The leaf is a factory of food, and within it are locked the secrets of the green cell and the intricate processes of photosynthesis.

PHOTOGRAPH BY THE AUTHOR

MASTERY of the secrets locked within the green cell will allow man to derive food and energy from the sun by methods of his own devising. He will then have thrown off the shackles of dependence on crop plants and can enter an era of unlimited abundance. A glimpse of that day has been provided in the plant physiology laboratory of the University of California at Berkeley. There Professor Daniel I. Arnon and his associates, Dr. M. B. Allen, Dr. F. R. Whatley, John Capindale and Lois Durham have succeeded in duplicating outside the living cell the process of photosynthesis, an achievement that has baffled science for three-quarters of a century.

Photosynthesis is the process by which the green chlorophyll bodies in plants, in the leaves especially, convert water and air into sugar and starch for food, and upon this all life found upon the earth depends. Until now, this important method of food manufacturing has been the secret of the living cells alone, where it has been in process for millions of years in the miniature factories of plant cells. Professor Arnon reported the discovery before the American Association for the Advancement of Science, December 29, 1954. It is through his courtesy that its main facts are made available here.

A leaf is made up of cells. Each cell is a complex "machine" in which many complicated processes are going on, all at the same time. A chloroplast is one of the tiny, green chlorophyll bodies found in a cell whose specialized work is that of photosynthesis. Only by separating the chloroplast from the cell could its special work be studied accurately. It was discovered that the chloroplast is a complete unit in itself, capable of carrying on the complete work of photosynthesis outside the cell.

There have been many attempts to isolate the complete process of photosynthesis outside the cell, but until now the main achievement made was the discovery—by Hill, in England—of the ability of isolated chloroplasts to use light energy to liberate oxygen, but not to convert carbon dioxide into sugar and starch.

This latter is the recent finding of Professor Arnon and his associates. They have also discovered that chloroplasts are the site of another photosynthetic process called phosphate photosynthesis, and they have discovered the identity of some of the new catalysts that effect it. Their discovery has isolated the complete photosynthetic mechanism, and provides a method for studying with certainty its detailed operations. (A catalyst is an agent or substance that produces decomposition and a new combination, by one substance acting upon a compound, itself remaining unchanged.)

Professor Arnon distinguishes three major processes in extracellular photosynthesis:

First; light (sunlight) is used to decompose water into *active* hydrogen and oxygen. By this is meant, raising to a high energy level. *Active* hydrogen, or high energy hydrogen, is the agent that accomplishes the synthesis (putting two or more things together) of organic compounds in the process of photosynthesis. Until now it was believed that it accomplished this by merely reducing the carbon dioxide, a gaseous compound of carbon and oxygen. This was the conventional carbon dioxide photosynthesis.

Second; the new discovery disclosed that in chloroplasts there is, in addition to the carbon dioxide photosynthesis, the previously mentioned phosphate photosynthesis, which takes place without carbon dioxide. Inorganic phosphate is transformed into an organic phosphorus compound, known as adenosine triphosphate, or ATP. "It is a universal constituent of all living cells, plant and animal," Professor Arnon says, "and is used as 'currency' for paying the 'energy' bills of the multitude of chemical reactions necessary for life."

Dr. Daniel I. Arnon is Professor of Plant Physiology at the University of California, where he did his undergraduate and graduate work, and to whose staff he was appointed in 1936. Except for three years in Army service and a year at Cambridge in England as a Guggenheim Fellow, his entire professional activity has been on the staff at Berkeley. He is a past president of the American Society of Plant Physiologists, and co-recipient of the Newcomb Cleveland Prize of the A.A.A.S. in 1940.

Another interesting fact was the identification of three catalysts of phosphate photosynthesis: Vitamin B2 (riboflavin), vitamin K (anti-hemorrhagic factor) and vitamin C (ascorbic acid). These catalysts are active in animal physiology as well as in photosynthesis, illustrating again the relationship of all living cells in both plant and animal.

Third; the reduction of carbon dioxide with the help of the light-generated phosphorus compound, ATP. Part of the *active* hydrogen and ATP combine with carbon dioxide to form sugar phosphates and then starch.

Radioactive carbon dioxide was used as an aid in following the processes of carbon dioxide photosynthesis, and radioactive phosphorus in the study of phosphate photosynthesis. The latter is being named photosynthetic phosphorylation.

After reading about this discovery, one's mind is impelled to glance back over the history of plant life as revealed in fossil formations. The process of photosynthesis must have originated millions of years ago, probably as far back as the Archeozoic era, with the first plants, which later became the earth's first coal beds. It was not until the Mesozoic era, some 1600 or 1700 million years later, that flowering plants appeared. By this time, photosynthesis was undoubtedly flourishing at its best in the plant world. Sixty million years later the seasons appeared and, 34 million years after the birth of seasons, man, who was to probe the the ages-old secrets of the universe. Since man's earliest history he has been fascinated by the curious processes in Nature; and has wondered many things about their origin. One of the most important has been the method by which plants manufacture the large part of their food from the air and water, and that which impels them.

It took six years of research for Professor Arnon and his associates to isolate the complete process of extracellular photosynthesis.

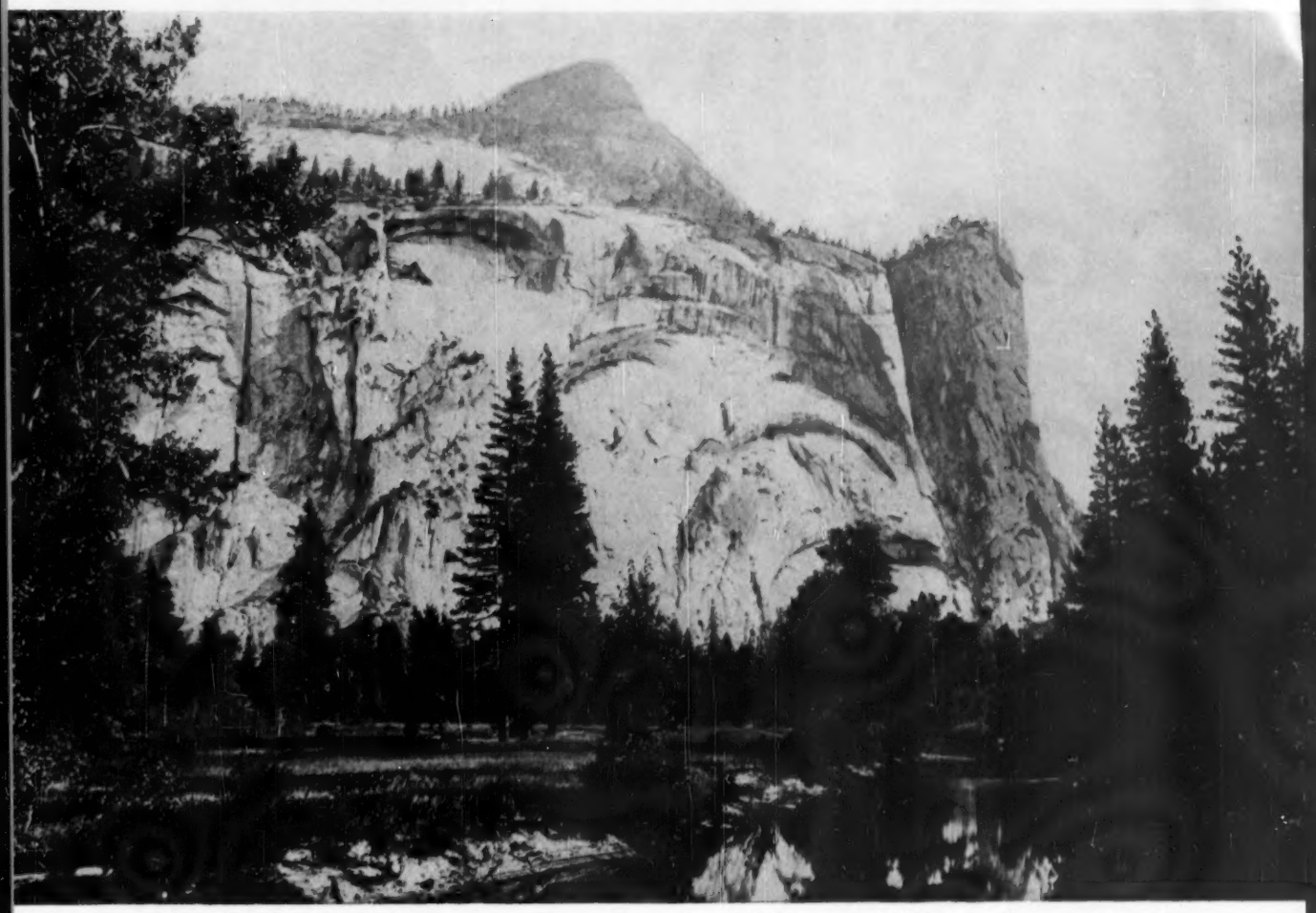
Professor Arnon says, "The achievement of extracellular photosynthesis brings nearer the day when man, after mastering the secrets of the process in green cells, will reduce his age-long dependence on crop plants for food and energy by devising his own photosynthetic reactions driven directly by the energy of the sun. When this proves attainable, it will usher in an era of unlimited abundance for the benefit of all mankind."

PEARLS

Yours is a birthstone fitting for a queen,
Who first beheld in June the break of day;
No other gem can share its lustrous sheen
Nor claim its origin in such a way.
Here is no dead and inorganic stone
Carved from a mountain, no rock or mineral
But far more precious, the pearl shall be your own
Culled from the living mollusk in its shell.

How right that June and pearls belong together,
Each with its own pale, summer-tinted hues,
Elusive, delicate, mirroring each other,
Pink dawns and saffron noons and dusks of rose—
Or, luminous against the falling night
The perfect black pearl and the matchless white.

Mae Winkler Goodman



The Royal Arches with North Dome, across Tenaya Canyon from Half Dome, and Washington Column at the right.

Historic Watkins photographs of 1861 show

Yosemite as It Was

By JEROME KEARFUL

EVERY visitor who records on film the scenery of Yosemite National Park, might well pay tribute to the man who, nearly one hundred years ago, took the first photographs there. His pictures, even now, are in many ways unmatched in their artistic conception and their feeling for natural beauty and splendor. His name was Carleton E. Watkins, and Mount Watkins is named for him.

Watkins, a native of Oneonta, New York, went as a young man to California in the wake of the Forty-niners. After finding gold mining neither profitable nor to his liking, he lived a somewhat precarious existence until a chance acquaintanceship with R. H. Vance, an early California daguerreotypist, resulted in his obtaining a position in Vance's San Jose studio.

Watkins had previously known nothing of the art, but in photography he now found his true calling. He learned all that there was then to be known, including the then new wet plate process, and, about 1857, set up his own studio in San Francisco. There he did portraiture and commercial work for the residents and merchants of that booming city. Also, he made periodic photographic expeditions by mule train into the trailless interior regions.

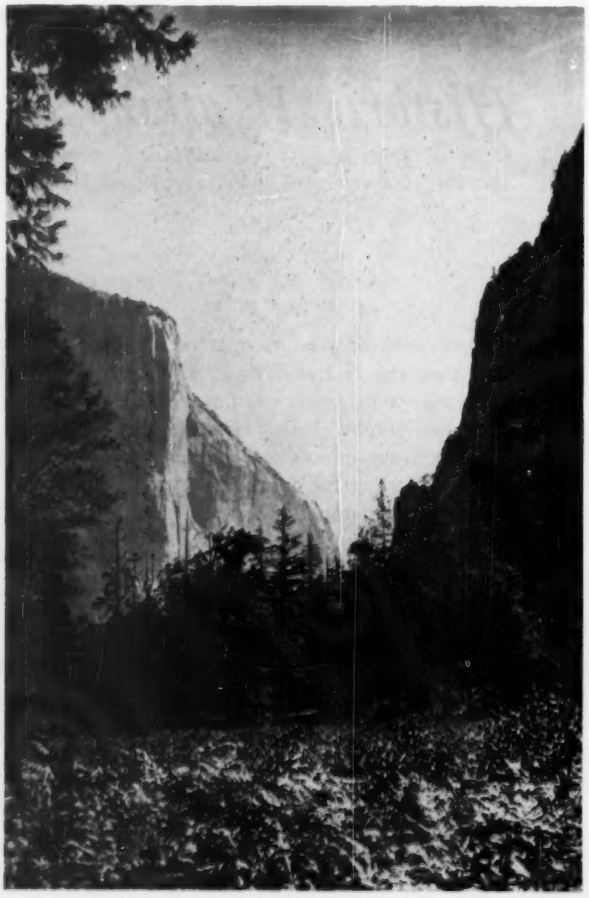
The San Francisco studio continued to be the center of Watkins' work until the great fire of 1906 destroyed most of his irreplaceable plates and equipment. By that time, his health had already badly failed, and, although he lingered on for several years, he never recovered from the blow.

In 1861, Watkins became the first man to photograph the wonders of the Yosemite. These photographs won wide fame for him, and the First Prize for photographic landscapes at the Paris International Exhibition of 1868. The Watkins photographs of the Yosemite, here reproduced in part, were a recent gift to the University of California at Los Angeles by Carl Dentzel, a private collector of Northridge, California.

Camp Grove, showing the tree growth in the Valley at the time that Carleton Watkins made his famous first photographs of Yosemite and won fame for them.

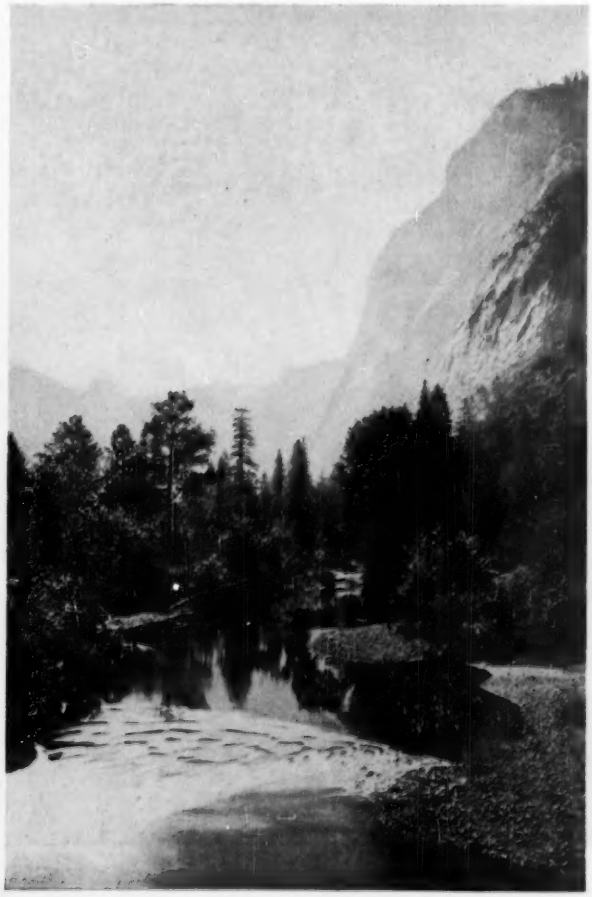
The lower fall of Yosemite Falls, the total fall of Yosemite Creek being a distance of 2425 feet.

The lush Valley vegetation and the sheer cliffs that the photographer found in Tutucanula Pass.



Half Dome, for a long time called "South Dome" and, by the Indians "Tis-sa-ack," for an Indian woman who, legend said, had been turned to stone for arguing with her husband.

Mt. Starr King, named for a Boston Unitarian Minister, an early admirer of Yosemite and speaker for it.



The Three Brothers, named for the three sons of Chief Tenaya, captured near the base of the formation.

The Indians called this cascade between Nevada and Vernal Falls "Yo-wi-we," which meant "Twisted water."

El Capitan rises 3600 feet above the Valley floor. Originally called Crane Mountain for visiting cranes.

The griffon vulture, *Gyps fulvus*, accurately described in the verse from Ezekiel that adorns this flight cage, is the "eagle" of the Bible. Mistranslations abound in Scriptures because, among other reasons, the English translators were unfamiliar with the wildlife of the Holy Land and lacked scientific training in zoology and botany. Scholars are still laboring to unravel the secrets of the true identity of many species mentioned in the Bible.

The present grounds of the Jerusalem Biblical Zoo and Botanical Garden have been thickly wooded for many years, but Dr. Shulov has planted new species. He hopes to continue until all "biblical" trees, plants and shrubs are represented. The almond is common in Israel, and a sprig of almond blossom brightens many a home in the rainy winter season. The relevant Bible verse contains five words in the Hebrew original, eleven in the exact English translation.

Jerusalem's Biblical Zoo and Botanic Garden

By MOSES ESKOLSKY

Photographs © by J. J. Breit

When Dr. Aharon Shulov, Professor of Zoology at the Hebrew University in Jerusalem, decided in 1940 to create a zoo, he set himself two goals. First, was a zoo that would contain the animals mentioned in the Bible, or at any time indigenous to the region of the Holy Land. A second aim was to enrich the country's depleted natural beauties, restoring many vanished species of mammals and birds that abounded before the forests were destroyed by centuries of war, erosion and neglect.

For several years Dr. Shulov assembled a representative collection of the fauna of the Bible, the only zoo of its kind in the world. In addition to his many other duties at the University, and as entomological adviser to the government in its disease-prevention campaign, he devoted all his spare time to this unique zoo on a purely volunteer and unpaid basis.

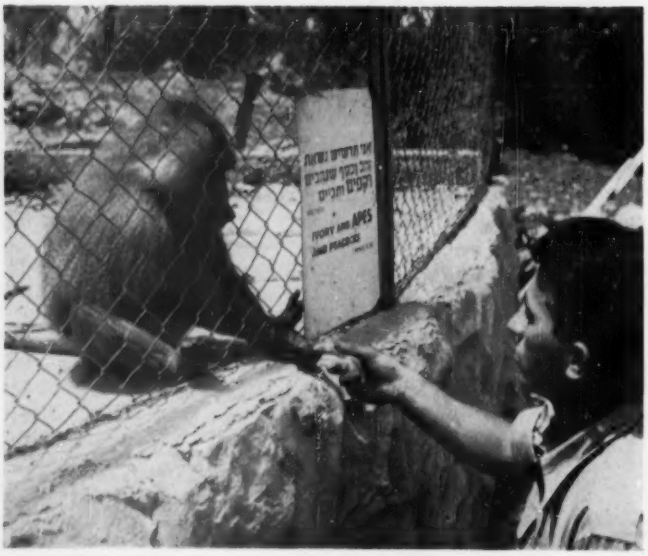
In 1948, however, like the forests in earlier times, the Jerusalem Biblical Zoo was ravaged by a war. Of the 450 specimens there when Israel's War of Independence began, only 22 survived. In 1950 the survivors were installed in a new park, a picturesque hillside site commanding some of the country's most beautiful views.

Here Dr. Shulov began again to collect the mammals and birds of the Bible. The Society of Friends of the Jerusalem Biblical Zoo was re-activated. Contacts were established with foreign zoos, and exchanges were initiated. Here, too, the Biblical Botanical Garden was inaugurated to exhibit the Bible flora, giving a rounded picture of the natural history of the Bible.

Modern civilization decrees that Israel, like other countries, will never again rejoice in the abundance of wildlife it knew centuries ago. But the Jerusalem Biblical Zoo and Botanical Garden makes it possible to gain some perception of what the Holy Land was like when the Bible was written. With the reforestation of Israel (now under way for *(continued on page 332)*

This monitor is believed to be the "chameleon" of the Bible. He seems to resent what he reads about his "unclean" status. The biblical injunction was meant in part to deter the ancient Israelites from eating the flesh of the monitor, which is still relished by primitive tribes in Africa. A monitor was the first exhibit shown by the Zoo when it was founded in 1940.

The first tree to be mentioned by name in the Bible, the fig has always been one of the Holy Land's most popular and useful trees. In ancient times it was a symbol of peace and security ("And Judah and Israel dwelt safely, every man under his vine and under his fig tree"—I Kings, IV, 25). The fig trees at the Jerusalem Biblical Zoo and Botanical Garden bear abundant fruits, and when they ripen in the late summer and early fall, the children pluck them freely to enjoy the treat. Here note the brevity of the Hebrew verse, with four words, as compared with the English version's ten.



The baboon is not an ape, but the Hebrew word "kof" (translated "ape") may well have referred to the baboon. The word "ivory" in the verse, Dr. Shulov feels, warrants the inclusion of an elephant in the Zoo's collection as a "biblical" animal. Moreover, archeologists have unearthed fossil remains of elephants in caves on Mount Carmel, so that it definitely qualifies as a species once common in the Holy Land. So far, the Zoo has not been able to acquire an elephant. It does have peacocks, the last item on the list.

The Russian names of the plants were added to the Hebrew, English and Latin in response to a request by a group of devout orthodox Russian monks and nuns. Some of them have lived in Jerusalem, at the Russian Cathedral and elsewhere, since the first world war, refusing to return to Russia after the revolution. Like many monks and nuns of various Christian denominations who live and serve in the Holy City, they frequently visit the Biblical Zoo and Botanical Garden and take an active interest in its progress.

An excellent modern-day example of how errors crept into Bible translations. For 1500 years copyists transcribed Bible by hand—a tedious and painstaking task. When a copyist's thoughts wandered, he was apt to copy a word incorrectly, an error perpetuated by all who used his copy, and all copies made from it, for new transcriptions. The errors made in this sign by the Jerusalem sign-painter, unfamiliar with English, were caught only after the sign was in place. The original verse from the Song of Songs begins "I went down. . ." The sign-painter, at home only with European languages, used the European "J" instead of the "I," and somehow managed to substitute "gone" for "went."

Creating a scene like this in Jerusalem, a town always noted for water shortages, is in itself no small achievement. Ducks and geese at the Jerusalem Biblical Zoo fly back and forth between two ponds, never leave the grounds. As in many other zoos, wild birds frequently drop in, stay a few days or weeks, then leave. Israel is an important station for scores of species commuting annually between Europe and Africa.

Most typical of Israel's trees is the olive, which grows in every region. The oil of the olive was used by the ancient Israelites in the Temple services, to anoint the kings of Israel, as fuel for the Eternal Lamp, and for other ritual purposes. The prophets spoke of the oil as symbolizing the rich fertility of the Holy Land.

Dr. Aharon Shulov, Director of the Jerusalem Biblical Zoo, holds a palm dove, *Streptopelia aequatorialis*, believed to be the turtle-dove of the Bible. The word "dove" was inserted into the original verse, which in English gives merely "turtle," to avoid the confusion aroused by the word "turtle" on a dove's cage.

The bear is mentioned twelve times in the Old Testament alone; the Syrian bear, *Ursus arctos syriacus*, to which the Bible authors referred was then quite common throughout the area. It is now extinct in the wild, the last one having been shot in northern Galilee about sixty years ago. Of the world's two dozen Syrian bears, seven are in Israel.

Not as Claimed

AN EDITORIAL

White oaks in the Seton Porter Forest in Missouri.

In 1953 National Distillers Products Corporation carried full-page advertisements in several national magazines, featuring the headline: "90,000 Acres of Natural Beauty...and Barrel Staves, Too!" The advertisement went on to say:

"It's a fact. In the heart of the Ozarks, National Distiller's 'cooperage reserve,' Seton Porter Forest, spreads over an area of 130 square miles...reputedly the largest privately owned hardwood forest in the country. This great woodland tract is a model forest conservation project. It is also a valuable source of supply for the important white oak needed to make whiskey barrels."

The ad explained that white oak barrels have to be charred to an exact depth in order to age properly the distilled products of this corporation.

"Meanwhile," the advertising continued, "Seton Porter Forest is conserved through selective cutting and replanting and its resources and natural beauty preserved for posterity. Thus National Distillers integrates a continuing source of this raw material with the manufacturing part of its business enterprises."

Today many of the larger users of forest products follow conservation practices, both in the harvesting of timber and in the maintenance of a sustained supply. Such a policy is both practical and good public relations in a country awakening to the basic importance of conservation of natural resources.

This, apparently, was the inspiration of the policy and advertising of National Distillers. Every industry that embarks on such a program is entitled to public applause and appreciation. Unfortunately, National Distillers Corporation is not so entitled.

Not long after the advertising cited here, they embarked on a cutting program promulgated by production men in their barrel plants, and against the advice and counsel of their forestry staff. As soon as the results of this destructive cutting became painfully evident, there was such a howl from far and wide that National Distillers decided to get out of the picture without calling any more attention to themselves than necessary. So they sold their land and timber, which had been registered as the first Tree Farm in Missouri. But they reserved the right to slaughter the white oak trees from fifteen inches in diameter up. This they have continued to do, until only a remnant remains of the virgin white oak forest of which they were once so proud. And butchering such a forest for barrel staves is one of the most wasteful of all uses of lumber, anyway.

Logging practices applied to harvesting this white oak timber have been reminiscent of the days of "cut and get out." Damage to young growth from falling timber, road-cutting and skidding in this forest has been appalling. The ecology of a white oak forest, which could have been maintained on a sustained yield basis, has been almost completely destroyed. There has been a waste and rape of valuable timberland incomprehensible today.

It may well be that the "big brass" in National Distillers Products Corporation does not know what is taking place. It might not recognize the unnecessary devastation if it saw it. But the testimony of competent foresters and woodsmen is plain, whether or not the facts may have penetrated to New York City offices. So it should be made clear for the record that this corporation is not only not entitled to public approval for progressive conservation policies, but is following practices that prevailed in an earlier and less enlightened day.

It is interesting, also, to recall that National Distillers was one of the large distillers that lobbied actively against legislation that would have permitted ageing bourbon whiskey in other than completely white oak barrels. They had the oak, and many smaller operators did not. The latter sought the right to use barrels of other wood, or made from laminated staves. Now that National Distillers are bent on consuming their white oak without regard to the future of their resource, it is more than likely that one day they will be back in support of a proposal that they once opposed.

Conservation and Nature are adventures to

CLASSROOM CAMPERS

It was almost dark as I parked my car by the side of the road. Looking in the direction of the San Bernardino Mountains, seventy-five miles away, I saw the raging fire that had been out of control for weeks. There had been forest fires every day during this hot summer in California.

A month later, while visiting Oregon and Washington, I saw thousands of acres of once fine forest that had lost the battle with fire. Only short, blackened stumps protruded from the ground to remind us that here was once a splendid green forest.

In the winter, back again in California, I saw tons of mud and debris that had been pushed up against houses in the town of Sierra Madre by the force of water rushing down burned-out mountainsides.

All these dramatic facts provided a natural way for me, a teacher, to stimulate interest in study of conservation and its relation to all. But it still took a lot of motivation to set forty city-bred youngsters to thinking about the consequences of one forest fire. There were always some children who had never seen snow, or a forest, or wild animals. How could one get them to understand the meaning of the peace and quiet of the woods? How could one describe the pleasant smell of wet decayed leaves, or the feeling of satisfaction that comes from a hike through a forest?

There would appear to be only one way for children, or anyone else, for that matter, to gain such an appreciation of our outdoors. The answer is quite obvious. Take them *out* to Nature. So, many school districts have started public school camps. Usually, each sixth-grade child lives in the camp and participates in all its functions for a week during the school year.

Through school camping much classroom subject matter can be learned by children in the open. With group planning, individual participation, and the sharing of responsibilities, the true concept of democracy can be understood by the youngsters. Healthful living can be emphasized through regular habits and by stressing personal cleanliness and hygiene.

School campers work on craft projects around a warm fire at Camp Colby, California. A teacher-counselor is at the left.

The idea of school camping as an added educational experience first flourished in Michigan about 1940. With the help of the W. K. Kellogg Foundation the first public school camps were begun there. By 1950 Michigan had more than sixty schools that provided a week or more of camping experience for their children.

In 1945 San Diego took the lead in California, and by 1950 Texas, New York, and Washington were experimenting with this new form of open-air education. We in America, however, are not pioneers in school-sponsored camping. England, Scotland, Wales, Australia, Tasmania, Union of South Africa, and British Honduras have had public school camps for many years.

In California, children from Long Beach have their Camp Hi-Hill, located on fourteen acres of the Angeles National Forest. The camp, at an elevation of 4250 feet, is only five miles from Mount Wilson Observatory, and twenty miles from Pasadena. Camp Hi-Hill, a

By JOSEPH W. WILEY

mile off the paved road in a heavily wooded area, is still near enough to Pasadena in case of any emergency. It is also close to the ranger station in case of fire. A few miles away is Camp Colby, used by two California school districts, Norwalk and Bellflower, suburbs of Los Angeles.

The bus ride to camp is always exciting and instructive. Counselors may discuss elevation and its effect upon plant life. As the bus passes the ranger station you can be sure there will be plenty of questions asked about the life of a forest ranger. Just looking out the window the boys and girls can get a good idea of what man has done to conserve water and halt forest fires by building flood control dams, fire control lanes, and ranger lookout towers.

After arriving at camp there is an orientation period. Then the daily schedule begins. Students set tables, do dishes, act as host and hostesses during meals and clean the dining room. Most youngsters work harder at camp doing dishes, cleanup, and other chores than they do at home—and they love it! Here, they are on their own, and they enjoy the extra responsibilities given them.

At the public school camp the director has a rating of an elementary school principal, and teacher-counselors are certificated elementary teachers. Helping the teachers are student-counselors who live in the cabins with the children. Other camp personnel includes cooks, and a caretaker.

The daily schedule is organized so that meal times are really the only periods during the day when children have to be at a certain place at a certain hour. Activities are planned flexibly to contrast with the many pressures under which youngsters live in city life.

Breakfast is at eight o'clock, and table setters have to climb out of warm sleeping bags ahead of the others. Those who do not have "mess duty" will clean cabins, shower houses, and the camp grounds.

About nine o'clock the teacher-counselors organize their groups for the morning activities. These are periods for real outdoor learning.

I watched as a pretty, blonde teacher-counselor, dressed in jeans, field shoes, and a bright red plaid woolen shirt, motioned for her group to gather around. The formality of the city classroom was nowhere evident. Leaning against a half-fallen tree, she began a discussion of how to read a contour map and how to use a compass. Her students sat around on logs and boulders.

There was definitely a feeling of freedom and enjoyment in being away from the routine of classroom schedules. The activity for the morning was a short hike through the woods to the old Indian museum and science cabin. I wondered how much we could learn in these few hours.

As we headed up the narrow trail, with the teacher-counselor leading, we paused for a few minutes. Miss

School routine is forgotten in this informal "classroom."

Youngsters have fun working on conservation projects.

Campers do their share in building steps on hillside.

Parkins, the teacher, pointed to a stone wall a few feet away against the side of the path. "The class before you started this stone wall," she said. "We're building it to keep the soil from being washed down on the path when it rains." Before moving on she promised us that we would have a chance to add our contribution to the project.

A few minutes later, we stopped again to look at work done by previous classes. "This is called 'wattling'," she explained. "These wooden stakes are driven into the ground at six-inch intervals, and then interwoven with pliable branches and twigs taken from the stream bed." She told us the wattling was done in this spot because of sloping land; during rainy periods, much of the topsoil had been washed away, leaving ever-widening gullies.

A discussion on erosion followed, and all Miss Parkins had to do to make the lesson understandable was to ask the children to look about them at what erosion had done. This was reading from the textbook of the outdoors!

The hike continued. There were cleared areas where other campers before us had planted seedlings of bigcone spruce, incense cedar, and redwood. We were told that later classes would replant these same trees when they became saplings.

Trudging along, we saw the small trees and shrubs that made up the elfin forest. We were told how important the root systems of manzanita, buckthorn, and greasewood are in holding the topsoil. I was amazed, and pleased, that so much could be learned, and taught so effectively, from one hike. No wonder many naturalists and conservationists support such outdoor educational adventure. How better could we inform our urbanized youngsters of the great natural resources which they have inherited, and which they must protect, if they are to keep them?

By now the sun was up. Jackets were shed as we made our way to the small cabin hidden in the shaded forest. Here was a real "science corner," right where it should be in its own natural setting. There were Indian relics, feathers, rock collections, bark specimens, snapshots of birds and mammals, and a varied assortment of other natural objects.

When all the questions had been answered and samples passed around, it was time to head back for lunch. We were ready. The brisk morning air, and uphill hike had whetted our appetites.

After a tempting spaghetti lunch there was a rest period. All campers had to lie quietly on their bunks. They could write letters, if they wished. There were some grumbles about "having to rest at a camp," but within fifteen minutes those grumbles had been transformed into long, heavy breathing, and complete silence settled over the camp.

I had accompanied the student-counselor to one of the cabins and sat in a chair to see how this rest period would really work. After fifteen minutes I settled comfortably on an empty bunk. I awoke only once during the hour to pull up the blanket. Glancing up, I saw the student-counselor dozing noisily in his chair.

At two o'clock there was another activity period. That day it was working on the stone wall, then filling in an eroded area with soil. Afterward, a forest ranger discussed fire prevention. He told us of the responsibilities campers must assume, and the role of the state and national governments in protecting forests, animals, and other natural resources.

From four-thirty to five-thirty campers had time to work on craft projects, read, plan activities for following days, or take short walks around camp.

After supper and dining hall clean-up an evening program was held outdoors around the campfire. There were stories, singing, and a history of the campsite told. Because of interest within our group, two nights were devoted to star study.

At eight o'clock it was time for showers, and then to bed; lights out at eight-thirty. By now the night air was cold, and as these youngsters climbed into sleeping bags, or underneath woolen blankets, they were already planning on the fun they would have twelve hours from then.

No matter how homesick some children might be, this was still fun and adventure. To a teacher it was a happy, meaningful, learning experience that could never be duplicated in a classroom.

As I lay there I wondered about the dozens of projects, discussions, and activities that could be continued after leaving camp and returning to "civilization." I thought of the great amount of textbook reading that would have had to be done to teach the things that these children had seen and touched. And I knew that no textbook, or classroom teaching could achieve the same results as muscles tired from building a rock wall, or the feel of packing damp soil around a seedling, or the fun of falling in a brook while watching fish or collecting twigs for our wattling project.

And I thought, reluctantly, that once back in the exhaust-laden air of the city we would not be able to smell the fragrance of the pine needles, or hear the water dancing over the rocks in the brook, or feel the sticky sap oozing from the conifers.

No, nor would we be able to sit on a log in the quiet darkness of a forest lighted only by the moon while a pretty, blonde teacher-counselor conducted such an excellent discussion of the North Star!

FLIGHT FORECAST

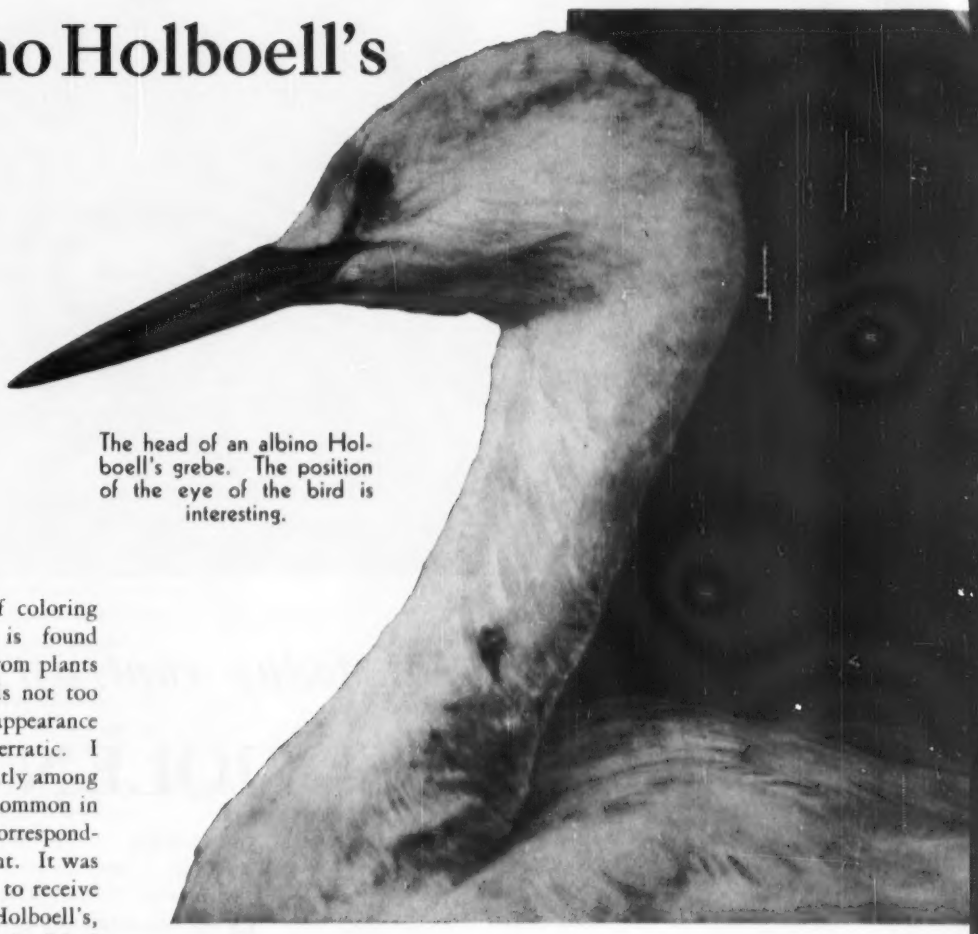
Velma Fehling

A little cloud is tethered to the blue,
Indicating weather;
Today it's a puff of white lamb's wool,
Tomorrow, a wild goose feather.

An Albino Holboell's Grebe

By H. H. PITTMAN

Photograph by the author



The head of an albino Holboell's grebe. The position of the eye of the bird is interesting.

ALBINISM, a deficiency of coloring matter or pigment, is found among most living things, from plants to man, but its occurrence is not too well understood, and its appearance under natural conditions is erratic. I have met with it most frequently among birds, but while it is not uncommon in some species in others it is correspondingly rare or apparently absent. It was a great surprise last autumn to receive a white grebe, presumably Holboell's, from southern Saskatchewan, for I had never met with or heard of albinism in the Colymbidae.

This bird, a male, was pure white with feet and bill yellow and the eyes pink—a perfect albino. It was fat and in excellent condition in every way; its plumage was heavy and good and it was well-fed. The stomach was filled with finely-ground vegetable matter, and all the internal organs appeared perfectly normal, refuting the popular belief that albinism is an indication of poor health or weakness. It was shot in flight near a place called Kronau in Saskatchewan during early October.

Perfect or complete albinism is rarer than what may be called partial albinism, and there is still much to be learned about it. Among domesticated creatures we know that it is hereditary and to a considerable extent on Mendelian lines, but there is little proof that conditions are the same with wild animals. Among my reference books I can find only two recorded instances of such an inheritance, which implies that it may be rare. While it seems that there must be some natural laws covering both albinism and its opposite, melanism, we cannot definitely say why some parents are unable to transmit the ability to produce color to their progeny.

It is not likely that albinism is a tendency to revert to an earlier type for many reasons. Being the offspring of normally-colored parents as a rule, each albino is an entirely new product, suggesting that Nature is tentatively experimenting. It is often said that dark-colored or black creatures are more subject to albinism than lighter ones, and crows and blackbirds are offered as proof of this theory. It is also pointed out that the change from black to white is usually abrupt and without the intermediate steps sometimes recorded among lighter-colored birds. Perhaps Nature *is* experimenting, for we know that a white race of a close relative of our crow is found in Austria.

In some ways partial albinism seems to be a different matter and due, sometimes at least, to understood causes. It must be remembered that white itself is a color and a decorative one, too, as in the familiar willet, for example. This, of course, suggests that while albinism perhaps indicates a lack of something, partial albinism may be just the opposite and be an excess—an excess of decorative coloring that may be caused by unusual vigor and virility. Even so, its uneven distribution remains a problem. Erratic white markings occurring in birds, mammals and also fishes are sometimes caused by external injuries but even the laws governing this are obscure. I have seen birds severely mauled by cats that survived for a long time in a crippled condition, I can almost say thrived, without showing a bit of white.

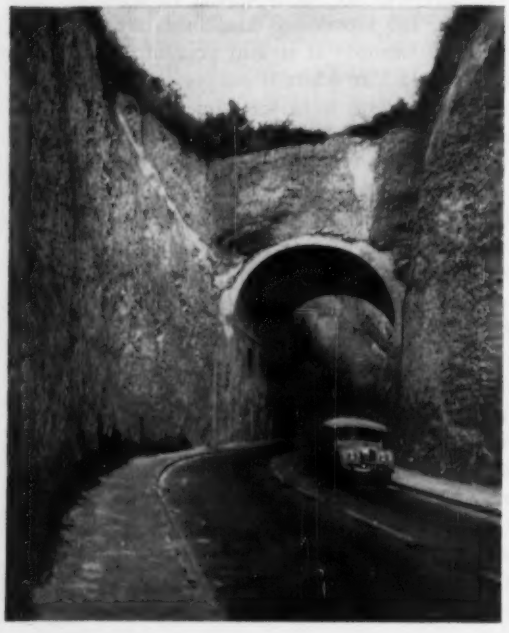
BERMUDA NEWS BUREAU PHOTOGRAPHS

The enchantment of today contrasts with

BERMUDA'S VIOLENT PAST

By MARY S. COATES

Black Watch Pass, a deep cut into the consolidated limestone dunes, north of Hamilton, capital of Bermuda.



BERMUDA is a land of enchantment where the lazy sun and balmy breezes offer a magic potion for relaxation and enjoyment. Pink-white beaches reach out to catch long turquoise breakers, curling and splashing with foam. In the distance huge gray rocks jut rudely into the sparkling water, as if to challenge the now peaceful sea. Soft tropic breezes occasionally rustle the deep green fronds of a nearby banana tree, or pick up the sweet fragrance of the frangipani. Pastel houses topped by dazzling whitewashed roofs nestle between the emerald hills, connected like beads on a chain by an occasional narrow, winding road.

Bermuda is a hook-shaped arc of more than three hundred islands lying along the southeastern edge of a broad elliptical platform that towers 16,000 feet above the floor of the surrounding ocean. This irregular oval of islands is about twenty-two miles long, but the islands themselves are only one-quarter mile to two miles wide. Thus, Bermuda's total land area is only twenty square miles. But since most of the island's underwater base is covered by less than sixty feet of water, a drop in sea level of sixty feet would increase the island area of Bermuda to two hundred and thirty square miles. This large, solitary shelf lies isolated in the Atlantic 580 miles from Cape Hatteras, the nearest land. Most people are amazed to find that Bermuda is more than two hundred miles closer to Nova Scotia than to Miami, Florida. It

An aerial view of Sandys Parish in western Bermuda shows the typical narrow width of the islands. The reefs in the foreground are ridges of aeolian limestone covered with thin layers of corals and other marine animals.

An eroded column of limestone illustrating the irregular cross-bedding in the solidified dunes, a characteristic feature of wind-drifted deposits. Weathering of the fresh limestone produces the pock-marked effect.

is the prevailing southwest winds and the warm Gulf Stream flowing by Bermuda's shores that warm it and encourage its semi-tropical flora and fauna.

Bermuda has not always been the paradise it is today, nor has it always enjoyed a balmy climate. The present island arc bears the traces of several hundred million years of geologic struggle. Incredible as it seems, the sleepy islands of today were once roaring volcanoes, spewing forth vast quantities of liquid rock.

One hundred to two hundred million years ago—perhaps even earlier—several vents opened in the floor of the Atlantic along a great fault line. Through this crack poured enormous quantities of molten rock and the slow-flowing, viscous magma spread out from its various cones in large flat sheets. The cones finally emerged from the water and formed volcanic islands several thousand feet above the surface of the ocean. Today the eroded stumps of these volcanoes form the main Bermuda platform and, a few miles to the southwest, the submerged Challenger and Argus banks. These two banks are separated from the main Bermuda shelf, and from each other, by deep valleys, now filled with sea water. Each bank is roughly circular and about twenty square miles in area. They were probably volcanic cones subordinate to the main Bermuda mass and eroded by sea action considerably below the level of the Bermuda platform. It is not known whether the former mass of the large platform consisted of several small volcanic cones or of a single massive mountain of lava, but, if one assumes the latter, 2500 cubic miles of magma would have poured forth to form one of the largest volcanoes of the world.

For millions of years the wind and water gnawed away at the shores of these volcanic masses. Slowly these erosive agencies forced the shores to retreat and reduced the elevation of the islands. Finally the remnants of the once formidable volcanic cones lay flattened and beaten beneath the waves. Although the volcanoes had died, Bermuda, as we know it, was yet to come.

Resembling miniature atolls, serpuline atolls, peculiar to Bermuda's south shore, emerge at low tide. They are remnants of the consolidated sand dunes encrusted along their outer edge with an elevated ridge of marine animals.

CHICAGO NATURAL HISTORY MUSEUM PHOTOGRAPHS

A view of the south shore of Bermuda. In the lower foreground a compact layer of marine limestone is visible, overlain by a thin layer of conglomerate and a thick layer of cross-bedded, windblown limestone, the deeply corroded remnants of former Ice Age sand dunes.

On the submerged remnant of the volcano small calcareous organisms began to grow. They flourished in the warm waters and built up colony after colony of their kind. Soon the whole platform was encrusted with these small animals. But the world was beginning to change. Gradually temperatures became cooler. The great Pleistocene Ice Age began—a million years ago. The northern ice mass inched its way southward. The ocean level gradually lowered as water was taken up in the formation of the great continental glaciers. It is estimated that, at their maximum extent, they lowered the level of the ocean about 260 feet. Former submarine mountains became land and present-day Bermuda emerged from the depths.

Strong winds began to blow outward from the ice mass as the polar storm fronts moved southward. These winds swept over the Atlantic and unceasingly attacked the newly emerged Bermuda shelf. The beaches of calcareous sand, made up of the skeletons of the tiny marine organisms and devoid of vegetation, were dried out, loosened, and heaped into high, shifting dunes. These dunes were piled up on the more southerly reaches of the platform, where they were protected from the strongest anticyclonic northern winds and waves.

Several times during the Pleistocene Ice Age, the ice mass slowly retreated, accompanied by a gradual return of a warmer climate and higher sea level. As a result, the lower sections of the platform were again submerged; the northern winds blew less strongly and protective vegetation began to grow. Increased rainfall percolated through the dunes, dissolving the calcium of the shell material and dropping it at a lower level. The shell grains gradually cemented together and the dunes became consolidated. Respite offered by the glacier's retreat allowed time for a thin layer of reddish-brown soil to form on top of the dunes. This process lasted several thousand years, but the glacier advanced again, bringing with it the strong winds and lower sea level. These two cycles were repeated several times, each glacial phase forming more calcareous dunes above the red soil of the preceding interglacial period.

Today we may read the story of the geologic stages, although only well logs, dredging wastes, and seismic soundings prove the former presence of an active volcano. The weathered volcanic material lies 250 feet below sea level, the firm dark layer of volcanic debris composed of a zone of unoxidized volcanic gravels and sands, rests directly on the truncated cones, and above this is a zone of soft, yellowish-brown volcanic material. These two zones differ greatly in color and appearance, although both are the products of the wearing away of the original volcanoes. The unoxidized nature of the sands and gravels of the lower zone shows that they were ground up by the constant movement of the ocean at considerable depth and were thus protected by the sea water from oxidation by the atmosphere. The upper zone, on the other hand, could only have been oxidized to so great an extent by the interaction of sea water and air, proving that this action went on near sea level.

BERMUDA NEWS BUREAU PHOTOGRAPH

An operating quarry showing the thin layer of topsoil and the straight vertical walls formed by chiseling and sawing into the limestone. The simple saws and chisels, visible in the background, are sufficient for extracting the soft blocks from the hillside.

The subsequent geologic events are clearly visible in the rocks of beaches and deep road cuts on the islands. Again the islands emerged, and from Pliocene to recent time, during the Ice Age, layers of eolian or windblown sand were laid down. There layers, which clearly show the cross-bedded stratification characteristic of wind-carried deposits, were formed during periods of low water. They alternate with thin layers of red-brown soil, weathered from the limestone when the surrounding ocean stood higher. While layers of soil were collecting on the land, during the interglacial periods of high water, compact marine limestone containing mollusk shells and foraminifera were forming on the lower-lying submerged parts of the islands.

Today most of the platform, the source of the dune sands, lies under a few feet of water. The winds, usually soft and harmless now, form no further dunes. This is a quiet time, geologically, for Bermuda. Although a few peat bogs are forming in low depressions, the weathering process holds sway. A thin layer of soil is accumulating from solution of the eolian limestone. Waves are slowly undercutting shoreline cliffs, chewing off pieces of rock that fall into the sea. Also a few strange erosive effects are visible. One of these is represented by serpuline atolls or boilers, peculiar to the south shore of Bermuda. These miniature atolls, barely emerging from the waves at low tide, are actually elevated (*continued on page 330*)

CAPITOL REEF

By NELL MURBARGER

Photographs by the author

"Egyptian Temple," one of many massive and beautifully eroded formations in Capitol Reef National Monument. In Capitol Gorge, below, solid stone walls tower sheerly up for nearly 1200 feet. At the narrowest point the walls are only fifteen feet apart at the gorge's bottom.

THIRTY-FOUR thousand acres of vivid color and fantastic erosion, Capitol Reef National Monument is in the center of a wide expanse of loneliness known as Wayne Wonderland. This was the last large area in Utah to be explored by white men, and one where access is still limited chiefly to pack trains and sure-footed mountain horses.

Established by presidential proclamation in 1937, the Monument lies on the east slope of Waterpocket Fold, an escarpment extending from Thousand Lake Mountain to the Colorado River, a distance of 150 miles. Throughout its entire length this fold, or flexure, may be crossed in only three places by horseback riders, and at only one point by automobile—this being through spectacular Capitol Gorge.

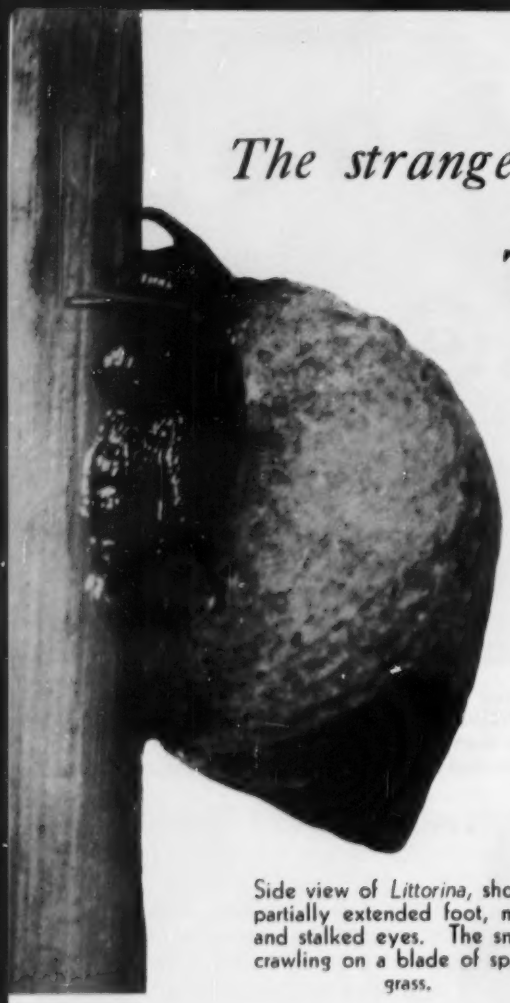
One of several precipitous rock slits tributary to the Fremont River, Capitol Gorge is considered by many to be the outstanding scenic attraction in the Monument. For four miles its bottom serves as roadbed for State Route 24, the main highway connecting Sigurd and Hanksville, as well as the only road giving wheeled access to the Monument. In its passage through the gorge this road bisects the breath-taking Narrows, where sandstone walls rise virtually sheer for 1200 feet on either side and at their bases stand only fifteen feet apart, thereby making it impossible for meeting cars to pass at this point. First white man to travel the length of the gorge is believed to have been Cutler Behunin, a Mormon pioneer, who laboriously made his way through about 70 years ago. The gorge was then so nearly impassable that its explorer required eight days to travel only three and one-half miles!

Despite the spectacular attraction of the gorge, the average visitor to Capitol Reef National Monument—and particularly color photographers—find their prime interest in the line of fantastically tinted and erosion-sculptured cliffs, which rise abruptly above the auto road for thirty-two unbroken miles. Composed of sandstone laid down in wide bands of red, brown, rust, maroon, purple, blue-green, and pinkish beige, this color extravaganza is capped by rounded knobs of white Navajo sandstone. One of these domes—by some thought to resemble the capitol dome in Washington—was responsible for giving the Monument the forepart of its name; the "Reef" portion of that title being a word used commonly in the West (*continued on page 327*)

The strange life of Littorina,

The Marsh Periwinkle

By J. J. SHOMON



Side view of *Littorina*, showing partially extended foot, mouth and stalked eyes. The snail is crawling on a blade of spartina grass.

IN THE vast, uneasy world of wetness between the tide lines in a saltmarsh hundreds of thousands of marine-loving animals choose to make their home. Many species have done so for five hundred million years; many do so today. There the ribbed mussel anchors its sessile body to root-stocks in the mud; the secretive clapper rail sounds its noisy castanets; the impassive *Littorina* leads the strange life of a gastropod on stalks of waving marsh grass.

It is an odd world, this area of neither total sea nor total land. It is a world of periodic dryness and wetness, where the threat of being baked to death by the sun is equaled by the threat of being drowned by the sea. There, for every predator that comes by land another just as deadly steals in from the ocean. There, subterranean enemies prowl by night and aerial dangers lurk by day. There, even the most delicate animal structures

Littorina irrorata in their favored habitat on the salt marsh flats of Virginia's eastern shore. The snails pepper the marsh grass as far as the eye can see.

The bottomside of the snail, looking up It crawls by muscular action of its oval, fleshy feet, led by the scent-awareness of its special feelers.

must match the rigors of the sea—storms and wave action, and winds and tide that have the power to move islands or make new lands.

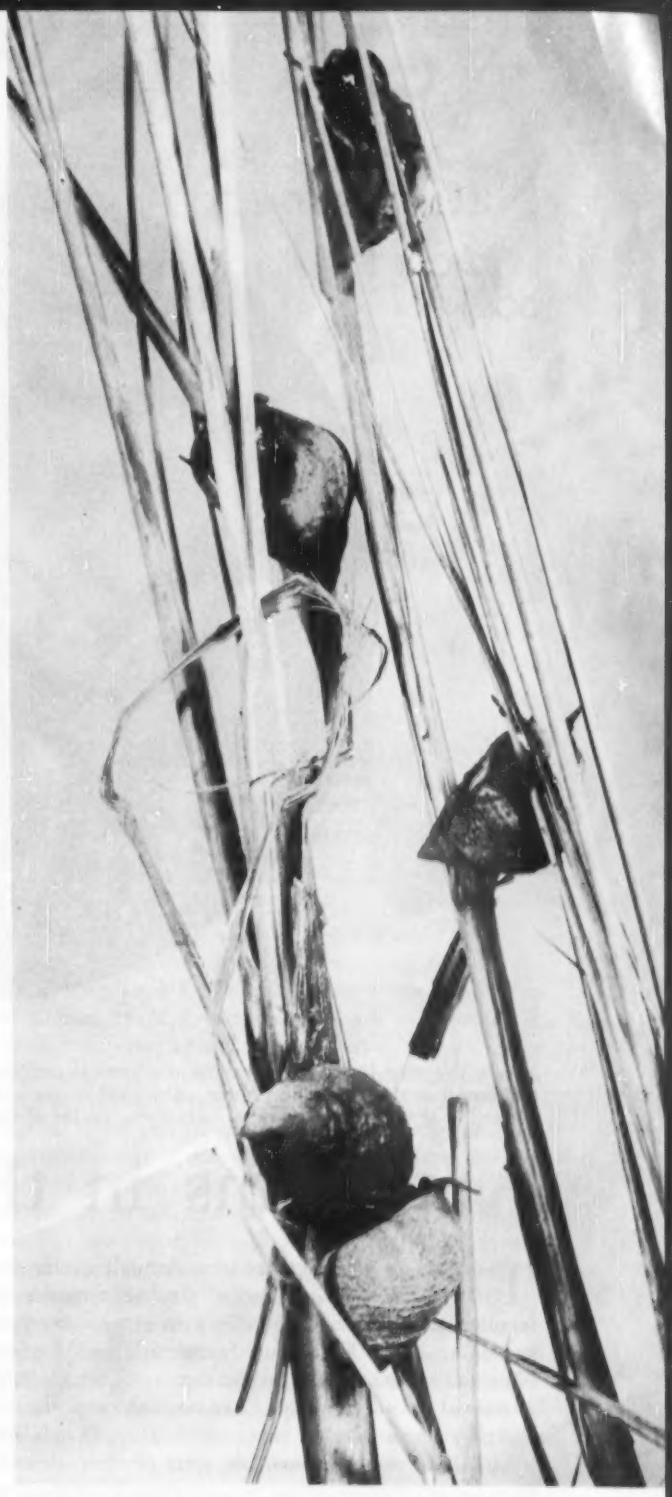
Into this halfway world of special adaptation the lowly marsh snail has moved to make its precarious home. Once abundant along the Gulf of Mexico, it has steadily moved northward until now it finds the Chesapeake marshes its ideal home. The choicest habitat for *Littorina* seems to be the vast, open stretches of savannah country that mark the saltmarsh flats of Virginia's eastern shore. Here two hundred square miles of spartina marshes provide a breeding area so favorable that the wet country literally blooms with periwinkles. From Chincoteague to Fisherman's Island, from Wachapreague to Cedar Island and Parramore, their numbers pepper the marsh grass as far as the eye can see. So thick are the marine dwellers in this area that one cannot set foot into the spartina without crushing a mass of them in the mud. On Cobb Island, north of the village of Oyster, I have counted as many as 140 pairs in one single square yard of watery space.

Natives in the Chesapeake marsh country refer to the *Littorina* snail as "periwinkle," the name assumed to be modified from "petty winkle," the small one, to distinguish it from its larger cousin, the winkle or whelk. Especially is this true in London and other foreign cities where snails are looked upon as a great delicacy. Although I have yet to sample the snail myself, preferring to leave such tidbits to the more venturesome clapper rail and herons, I see no reason why they could not be eaten in quantity if properly prepared. In Holland, Denmark and Britain, the smaller periwinkles are boiled, or steamed, and the fleshy parts picked out with a pin.

Although about 150 species of periwinkles are known to favor the wet zone habitat, it is *Littorina irrorata*, the lined or marsh periwinkle, that has found the environment ideal. Today its numbers are still spreading, and it is known as far north as New Jersey and beyond.

Littorina lives for the tide. Encased in its inch-long shell of hard calcium, it sifts and scrapes out the goodness from plankton and algae washed to its door by the twice-daily sweep of the tides. Then it seals itself tightly against dry air, like a rubber jar top, as the salt water drops and ebbs back to the sea. It is a monotonous existence, but it is the only life that *Littorina* knows, an existence that has proved safe and good for uncounted generations of its kind dating back to the geologic past. Death is certain below the tide lines. There constant brine is suffocating. Death is also sure above the wet zone, for the snail needs moisture for its existence. So *Littorina* clings to its mother grass, the spartina, content to spend its time in rhythmic feedings between the tides, followed by long periods of waiting and slumber and occasional imperceptible movement up and down the twelve inches of marsh grass that furnishes its warm-weather home.

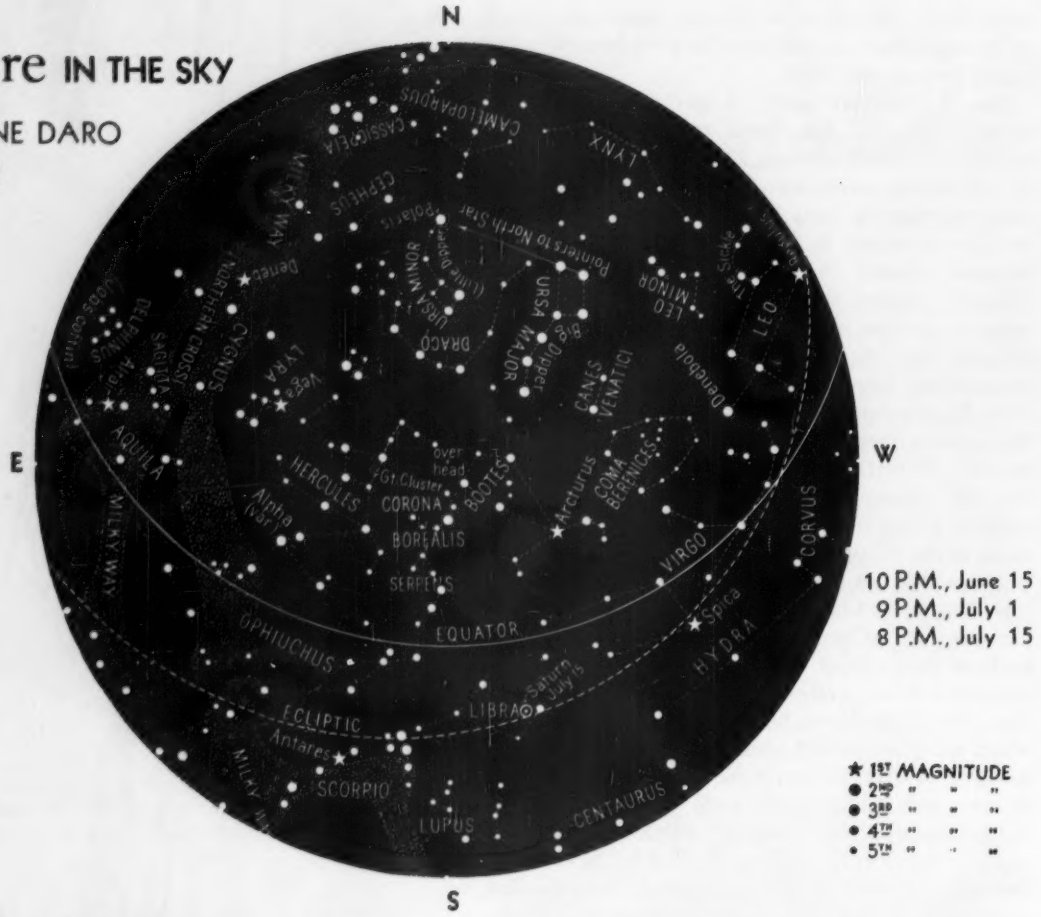
Like other marine mollusks of the world, numbering some 80,000 forms, the periwinkle is moved by temperature. When the warm rays of the spring sun penetrate its calciferous outer body, the urge to move, feed and procreate is manifest. Certain specially adapted structures come into play. Out of the shell orifice comes the soft snail body to begin a period of exploration and slimy movement. When fully extended, the foot becomes as long as the conical shell itself, and is capable of exerting prodigious strength. (*continued on page 327*)



Closeup of marsh periwinkles of stalks of salt water marsh grass, *Spartina alterniflora*, a growth common to the Chesapeake marsh country.

Nature IN THE SKY

By SIMONE DARO GOSSNER



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. Times given are for Local Standard Time.

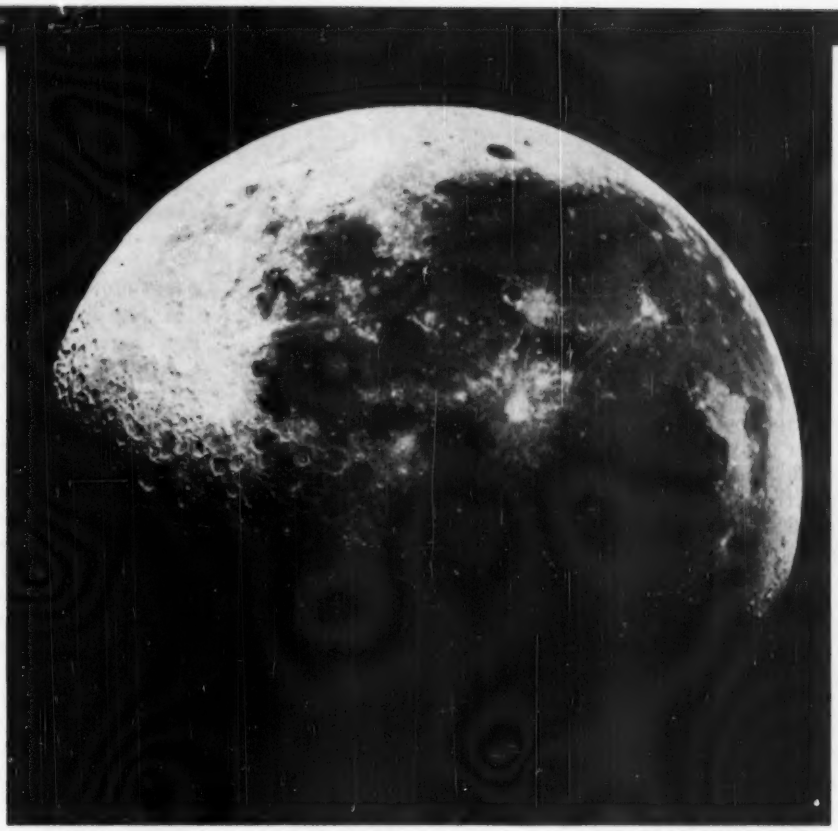
Americans in the Moon

THE SURFACE of the moon, seen through a telescope, has a mottled appearance. Its most noticeable features are classified generally into three categories. First, the *craters* have roughly circular, raised edges, often with a small peak in the center. They resemble terrestrial volcanoes. Second, the *mountain ranges* stand in sharp outline and reach enormous heights, as indicated by the shadows they cast. In spite of their altitude, they are never snowcapped because there is no moisture on the moon. Third, the *seas* and *oceans* are large, smooth areas whose appearance misled the early astronomers into thinking they were large bodies of water. We know now that the moon has no water and that the word desert would be more appropriate, but the name sea has been retained in the conventional nomenclature. The larger seas are visible to the naked eye and produce the well-known features of the man in the moon.

Owing to a peculiarity of the motion of the moon, not much more than half of its surface is known to us. Its period of rotation is exactly equal to its revolution around the earth, with the result that the same side is always facing us. Fortunately, the axis of rotation is tilted somewhat, allowing us to see alternately the moon's north and south poles. At the same time, its speed of revolution around the earth is not constant, being faster at perigee and slower at apogee, according to Kepler's law of areas. This allows us to see a little bit around on the eastern and western sides. Altogether, we manage to see approximately three-fifths of the moon's surface.

An interesting project in rocket engineering would be to launch a missile, loaded with recording equipment, to go all the way around the moon and return to earth. At this time, such an idea still belongs to the domain of science fiction, but, in the not too distant future, this might well afford us our first photographic glimpse of the moon's other side.

The first man to name the features of the lunar surface



OFFICIAL U. S. NAVY PHOTOGRAPH

Owing to a peculiarity of the motion of the moon, not much more than half of its surface is known to us.

was the Belgian Langrenus, whose map was published in 1645. The names he used were those of his patron, Philip IV of Spain, and of several other princes and princesses, as well as those of contemporary astronomers.

Two years later, Hevelius of Dantzig published his *Selenographia*, in which he designated the lunar markings by the names of terrestrial seas and mountains.

Riccioli of Bologna followed soon after, in 1651, with his *Almagestum Novum*, which included a map of the full moon bearing his own designations. He used terrestrial names for the mountains, and symbolical ones for the seas, reserving the personal names for the craters. This consistent scheme has been retained to this day.

Many names were added in the centuries that followed, and the confusion became such that the International Astronomical Union instructed its Lunar Commission to make a survey of the various designations, and to establish a definitive catalog. This project was completed in 1935.

The list of 609 crater names constitutes a remarkable roster of astronomers, geographers, and patrons of astronomy, of all times and nationalities. Of these, twenty-one are Americans, a gratifying number if one considers that astronomy did not flourish in this country until the beginning of the nineteenth century, at which time about two-thirds of the lunar craters had already been named. The Americans who have thus been honored have all contributed to the progress of astronomy and related sciences, either by their pioneering research, or by their material support. The limitations of space do not permit even a thumbnail biography of all twenty-one; a selection must be made, however arbitrary.

Among the patrons, we find James Lick of Pennsylvania, manufacturer of musical instruments, who gave the University of California the funds to provide "a telescope superior to and more powerful than any telescope yet made, and a suitable observatory," thus founding the observatory that bears his name; and Charles T. Yerkes, Chicago industrialist, who financed the construction of the world's largest refractor for the University of Chicago.

The natural sciences are represented by Benjamin Franklin, who needs no introduction, and by the Swiss-born naturalist Louis Agassiz, founder of the Harvard Museum of Comparative Zoology.

The development of photography at the beginning of the past century opened a new field in the realm of astronomy. It is only fitting that the pioneers of celestial photography be so well represented on the moon. William C. Bond, first director of Harvard College Observatory, exhibited his daguerreotype of the moon at the Great Exhibition of London in 1851. George C. Bond, his son, succeeded him as director of the observatory, and was a pioneer in stellar and cometary photography. Henry Draper took the first photograph of the Orion Nebula in 1880. Edward C. Pickering, another director at Harvard Observatory, initiated the photographic survey of the heavens carried out at that institution. His brother, William H. Pickering, supervised the establishment of Harvard's southern observatory at Arequipa, Peru, (transferred later to South Africa). He began there his lunar studies, (*continued on page 331*)

Nature IN THE SCHOOL

By E. LAURENCE PALMER

Professor Emeritus of Nature and Science Education, Cornell University, and Director of Nature Education, The American Nature Association

So they say

RECENTLY the doctors ordered me to stay put for two or three months. I obeyed their orders, sorted mail and other papers that in more than thirty-five years had totalled nearly a ton. I caught up on correspondence that had been put off indefinitely (one letter was three years old), and put in a box a series of quotations that had accumulated through the years. Some years ago, under the title "Desk-drawer Dregs," I published on this page some of the reports and experiences that I had had, and which seemed to me to be absurd. Here I propose sharing with you some of the cogent expressions of the great and the near great—and even of some of the not great at all—that to me at least seemed important enough to save and to think about.

Last night at a party the discussion veered around to what could be done to survive in case of an H-bomb attack. One of the finest members of the party made what seemed, at first, a surprising comment. She said that in case of an H-bomb attack she hoped she would not be a survivor. I have been thinking about the remark ever since. Maybe she was right. However, the thought is so contrary to a life-time habit of reasoning that I want to reserve judgment. Perhaps I want to reserve judgment on a lot of things I had come to think of as settled. Maybe I do not want to go down with the ship without a struggle.

A few clippings that have challenged me to a little thinking about education may be worth listing. George Bernard Shaw told us that "civilization is education's race with disaster." Plato tells us that "no study pursued under compulsion remains rooted in memory." Bernard tells us that "trees and rocks will teach what thou canst not hear from a master." Bennett gives us the statement that "education is possible only through the student's activity." Mulling these things around in my mind, I really wonder what education may be, and if it is really getting anywhere.

A college dean last week was winging his way south for a few days respite from administrative duties to collect a few shells. His seat-mate was a graduate student in education who, seeing my friend look over some of his shell pictures, sagely remarked that they were shells. The education major asked my friend why he was interested, and the dean said that he was on his way to the Bay of Campeche to collect some more shells of the genus in which he was interested. The embryonic pedagog wanted to know where that bay was. When he was told it was to the west of Yucatan he still was lost.

What sort of a teacher?

Both the dean and I wondered what sort of teacher that fellow would make, and why the teaching profession is so insistent that its recruits undertake work in professional education, regardless of whether they know anything outside that field. An unnamed sage is reported to have said "You can't no more teach what you don't know than you can come back from where you ain't been yet." Today I received a letter giving suggestions for organizing a huge national meeting. The correspondence dealt with the details of organization without once giving any suggestions as to what the purpose of organization might be, or suggesting any specific things that might be done. If civilization is education's race with disaster, then the education hare may need to be urged on before the finish line is crossed by the tortoise of disaster.

Someone has written: "No man should be forced to read a book or to study a lesson; the world needs men to carry water and to mark time for those of higher mental calibre." Somehow, as a teacher, I gag at that. Somehow I feel that discipline has a place in the scheme of things, and that a wise application of force may, in the long run, yield good results. Horace Mann said "Habit is a cable. We weave a thread of it every day, and at last we cannot break it." And I believe it was one of the Huxleys who said that an educated person was one who had learned to enjoy doing what had to be done. For what are we in Nature work striving? Why are most of us so thoroughly happy doing what we are doing?

At the opening of his school in Penikese, Louis Agassiz told his students "I shall never ask you to repeat what you have been told, but will constantly ask what you have seen for yourselves." Wells tells us, "Science knows no authority other than the prowess of observation." Again Wells says, "Modern science owes its lusty growth to the fact that it has always searched for truth by direct observation." Anna Botsford Comstock told us, simply, "Nature study is, despite all discussions and perversions, a study of Nature; it consists of simple, truthful observations that may, like beads on a string, finally be threaded upon the understanding and thus held together as a logical and harmonious whole." Possibly we in Nature study and science education can believe that what we are trying to do is to present the truth of Nature so simply that others may understand it. Ruskin said, "The greatest thing a human being ever does in this world is to see something and tell what he saw in a plain way."

Disciplines are imposed by facts

It is not always easy to teach in this field of Nature and science because of the disciplines imposed by the necessity of heeding facts. And teachers, like others, do not always recognize significance in Nature that lies before them. I saw the same things that were observed by the discoverer of penicillin, but I saw no significance in them. Yet had that drug been discovered three or four years earlier it would have changed my whole life. Burroughs says, "The gold of nature does not look like gold at first glance. It must be smelted and refined in the mind of the observer. And one must crush mountains of quartz and wash hills of sand to get it. To know the indications is the main matter." Burroughs was a rather hopeless naturalist, viewed in some lights, but he hit the nail on the head when he tried to get others to share some of the experiences with Nature that meant so much to him.

Somewhere in all this trying to get the most from Nature for ourselves and our fellow men comes a time

when we need to do a little self-evaluating. We need, even, to have a little faith in things beyond the teachings of the laboratory and field experience. Barnard tells us, "A truly scientific mind ought to make us modest and kindly disposed. We know so little in reality, and we are all fallible when faced with the immense difficulties which the investigation of natural phenomena presents us." Pasteur expressed a bit more faith in man's ability to be master of his own world when he wrote, "My invincible belief is that science and peace will triumph over ignorance and war, that nations will unite, not to destroy but to build, and that the future will belong to those who have done most for suffering humanity. But whether our efforts are favored by life, let us be able to say when we come near to the great goal, 'I have done what I could'." To some, it seems embarrassing to think of modern France in terms of Pasteur's philosophy.

Ted Malone summed up a pattern for living without any reference to science or Nature and yet useful to those of us who teach, or try to teach, in that field. He said that the year of life was made of the eleven months—Faith, Laughter, Humility, Courage, Work, Honesty, Wisdom, Love, Understanding, Charity and Sorrow. And he said that if we mastered these eleven months we would find Peace the twelfth month. It is difficult to apply this measuring stick to some individuals and nations of our modern day, and sometimes to ourselves.

David Starr Jordon, that great enemy of war, told us, "The study of nature gives us a certainty as to certain facts which no waves of sentiment can change, it leads to a sure knowledge of some things which no weight of authority on the other side could possibly shake. 'This is the value,' Agassiz once said, 'of the study of nature herself. She leads us back to absolute truth, wherever we may wander'."

Sometimes it is a bit tiring to follow what all these writers were trying to tell us. Sometimes we find it necessary to look beyond mere facts, beyond even mere survival. To me the most helpful quotation in such circumstances comes from some ancient Chinese who said, "If thou hast two bowls of rice with which to fill thy belly, sell one and with it buy a bowl of daffodils with which to feed thy soul." ❦ ❦ ❦

Periwinkle

(*continued from page* 323)

As the snail makes its way over the spartina or mud surface a special slimy mucous is laid down over its trail and allows ease of movement.

It is at night, or on dark days following the wash of the tides, that the snail pushes out its cold fleshy foot, extrudes its stalked, unseeing eyes, and, led by a dull scent-awareness of its feelers, sets forth on its sojourn of exploration. Breathing is by means of rudimentary gills, obtaining oxygen from sea water, into which waste gases are dissolved.

From the delicate mucid flesh of the head project tiny structures that help the snail to distinguish between light and darkness. Two slender peduncles, or stems, project out of the head, like antennae of a moth, each tip of which terminates in a half-seeing eye. Close by are two other tentacles, shorter structures, sensory organs by which the snail is able to locate its food by means of scent. The mouth is on the underside of the fleshy foot, near the front, and takes the form of a cup-like disc in which is hidden a powerful radula or rasping tongue with which the snail is able to rasp off particles of vegetative food from plants or other sessile marine animals. The radula is highly special in that it is equipped with hundreds of backward-pointing, tiny teeth, which, in some snail forms, are capable of penetrating the hardest kinds of shells.

Littorina is a hermaphrodite, having both sperm cells and eggs, but it is not capable of self-fertilization. Like other snails it couples with others of its kind, goes through the regular process of mating and fertilization, and gives rise to a cluster of seed-like eggs, which, before cold weather, soon turn into a new generation of periwinkles.

In the autumn, when the winds stiffen their onslaught from the sea, and the temperature drops to a new cold, the slow and inactive *Littorina* feels the urge for long slumber. Quietly and obscurely as it has mated, it glides down the stalk of spartina searching for a resting place. Sometimes it finds a wide stalk base to its liking and remains there. Sometimes it moves all the way down to the mud and there, with others of its kind, it finds a shallow shelter and goes to rest. As the cold increases in the marshes, the sluggish snail sinks deeper and deeper into physical torpor, blood slowed to nothingness, its faint body awareness weaker and weaker until life itself seems at an end.

When excessive cold finally forces the epiphragm to close the shell entrance, *Littorina's* life is lost to the world. It may be a final closing, ending in death itself, as often happens every four or five years. Perhaps it is only an act of hibernation, a half-sleep, a semi-wakefulness, the process of sleeping of all snails, followed again in the spring by rude awakening, led by the urge of hunger and movement and procreation. Such is the destiny of *Littorina*, the strange life of breathing and feeding and moving about on its muscular foot along the mud surface or the waving spartina; of begetting other generations of periwinkles; of silent crawling and timeless waiting—waiting for the washing tide and the plankton and the algae; waiting for new life; waiting for certain death. ❦ ❦ ❦

Capitol Reef

(*continued from page* 321)

to designate an upthrusted area of rock terminating in a cliff face.

Many descriptive names have been given to the Monument's various eroded forms, which give this area what has been called "the fantasy of Bryce and the grandeur of Zion National Parks, with more color than either." One of the most massive and beautifully carved of these formations is "The Castle," while "Mummy Cliff"—chiseled by time, water and wind, from a dark-red shale known geologically as the Moenkopi Formation—bears striking resemblance to a mile-long row of Egyptian sarcophagi.

To the geologist the deep erosion here presented affords an excellent opportunity for studying the page-by-page blueprints of Earth's formation from the Age of Reptiles, six different strata of the Triassic, Jurassic, and Cretaceous sediments being displayed as if a gigantic birthday cake had been cut, and its six layers—each of a different color—exposed to view. Numerous marine fossils occur at several points in the Monument, and in the maroon-colored Chinle shale are found large quantities of petrified wood, indicating that millions of years ago a giant forest flourished on this site, where the tallest trees found today are pinon pines and junipers. ❦ ❦ ❦

The Tetons are behind the persistent formation of clouds, which did not make photography possible, although there is real beauty in the festoons of cloud.

Morning is the best time to photograph the Teton range, but during my stay in the region the clouds did not clear the crests until nearly noon.

THE Nature CAMERA

By EDNA HOFFMAN EVANS

Camera Four Ps

PHOTOGRAPHERS ARE PEOPLE. Whether they are peculiar people or not I have never quite been able to decide. Sometimes I think we photographers are a crazy, mixed-up lot, and at other times I am sure we are completely sane. It all narrows down, I guess, to what the old Quaker is supposed to have said to his friend. "Everyone is crazy except me and thee," quoth he. Then, after a moment's thought, he added, "And sometimes thee is a little crazy, too."

I have often wondered why some people become camera fans and others never do. For that matter, some of us like model airplanes and some of us do not; some of us like to cook, while others never even learn to boil water. The same holds true for painting, for music, for sewing, for various forms of sport; in fact, for just about any form of human endeavor that goes beyond the daily tasks we must perform in order to eat regularly. Sometimes it even applies to them.

Not all photographers, by any means, are Nature photographers for Nature photography is a special subdivision of a specialized field. Nature photography, to my way of thinking, is more general in meaning than the term "wildlife photographer." Perhaps I am wrong, but to me the term wildlife photographer means someone who actually specializes in wildlife—he seeks his quarry in the depths of jungles, or in forests; he goes on expeditions; he slogs through swamps, or hangs precariously from cliffs in order to picture subjects that really are wild, be they plant or animal.

A Nature photographer, on the other hand, may photograph wild creatures; but he also will see beauty, charm, and photographic possibilities in "tame" subjects; in flowers from the garden, in domestic pets, in birds that are wild only in the sense that they are not confined in cages. He is equally at home with the majesty of distant landscapes and seascapes, and with close-up, relatively insignificant things like a toadstool on the lawn, a delicately shaped (but not rare) shell on the beach, or a snow-covered bit of shrubbery.

There are four qualities that I think every Nature photographer should possess in order to take the best pictures he can, and at the same time stay sane and sensible. The Four P's of Photography we might call Patience, Persistence, Preparedness, and Philosophy.

The ability to wait

Patience is the quality of being able to wait, whether the waiting be for a few minutes, a few hours, a few days or weeks, or perhaps even from one season to another over a period of years. The Patience of the photographer is not the patience of Job, for in the case of the Old Testament character "patience" meant endurance under adversity. The photographer does not have to endure anything, except perhaps frustration, the misunderstanding of non-photographic friends, or an occasional scratch, bruise, or mosquito bite encountered in the line of action.

The patience that a photographer needs is the ability to refrain from action, to wait in readiness, until the proper moment. There are many phases of Nature photography that call for patience. A photographer may have to wait for the right light, for the sun to come out from behind a cloud, or for the exact desired area of shadow. He may have to wait for the breeze to stop blowing, for a bird to return to its nest, for an animal to raise its head, or for the satisfactory grouping of several subjects.

Patience is demanded, too, when subjects perversely refuse to cooperate; when the bird flies away an instant before the photographer clicks his shutter; when the painstakingly posed cat or dog yawns, sits down, stands up, or moves just as the photographer is ready to take a picture.

The photographer may be all

ready to take a series of landscape shots, only to find, on the appointed day, that there is not a cloud in the sky—when clouds are much to be desired. Or, just the reverse, there may be an overall blanket of cloud that equally defeats his purpose. On a day at the shore when slow, oily swells are desired, the waves may be lashing white and sending spray high over the breakwater. Or, when real waves are desired, the sea may be as calm as the traditional mill pond.

What does the patient photographer do in cases like this? He is patient. He sits down to wait. He holds himself in readiness until the effect he desires is available. He spends a day where he intended to spend only an hour. A photographer I met recently has his car so arranged that he can sleep in it if the situation requires. Many of his subjects are to be found miles from his base of operations. Thus, if conditions are unsuited to his needs at time of arrival, he settles down to wait—all day, all night, or even several days, if necessary. Other photographers, not so equipped, go back and go back, until they finally hit upon the right combination.

The ability to go back

The ability to go back and try again leads us to the second of the Four P's of Photography. This is Persistence, or perhaps it might be called Perseverance. It is the ability to stick to a task until said task is accomplished.

Few good Nature pictures, I think, would have been taken had the photographer not possessed this quality. Sometimes, by a happy combination of circumstances, the first picture is the best one. But all too often this is not the case. The photographer must try, again, and again, until he gets the effects that he desires. He may try for days, or even years, until he gets them, but try he does, persevering until he attains his goal.

Preparedness is another "must" for the Nature photographer. Often heard is the remark: "It would have made a wonderful picture, but I did not have my camera with me that day." How often, for that matter, has the same thing happened to you?

Whenever possible, the Nature photographer is ready at all times to take advantage of chance shots, of fleeting photographic opportunities that may never present themselves in that exact way again. I can recall, for example, the time the bear cub stood up on its hind legs in Yellowstone, making a striking picture against a small pine tree, just when I was shifting from color to black-and-white camera and consequently had neither one focused. I can remember waiting one day too long before taking the picture of a nest full of baby mockingbirds, but some cat, snake, or other marauder beat me to them. The day the family of five raccoons moseyed across the highway in front of my car in the Okefenokee was the day I neglected to load the camera before starting. As for the beautifully antlered buck in the Kaibab forest, I took an instant too long to focus and he faded from view among the trees. And so it goes, in any Nature photographer's book of experiences.

Photographs and philosophy

This leads to the last of the Four P's—Philosophy. We have to be philosophical about these things, to shrug off our failures and our defeats, and to bounce back, still photographing. It is not always easy to do this, particularly in the case of experiences that are rare, expensive, and hard to come by.

My experience in the Tetons last summer is a case in point so far as my own photographic philosophy is concerned. The Grand Tetons; the Jackson Hole country; the Alps of America; the beauty spot of the West; the most perfect range of mountains; the most magnificent scenery in North America! I had heard all this many times, and I had looked forward to seeing them. Finally, I arranged to drive more than a thousand miles out of my way in order to visit and photograph them.

So what happened? You guessed it; bad weather. To begin with, the entire season was a dry one, dry there and dry farther east. The glaciers that usually nestle like blue-white gems in the crevices were smaller than usual, they told me. Besides that, they had a grimy, dirty appearance, the result of drifting clouds of dust, windborne from the parched fields of Kansas and Oklahoma where a new dustbowl was supposed to be in the making.

But even the dusty glaciers were not always visible. Rain clouds or fog masked them much of the time I was in the area. And, when the clouds did lift, when did they choose

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to do it? At the wrong time of day, of course.

The Teton range is a small one, comparatively speaking, extending about thirty miles north and south, with Grand Teton Mountain, the highest pinnacle, towering into the sky some 13,766 feet above sea level. Running north and south as they do, the Tetons are best photographed in the morning when the light is from the east. When the sun crosses the zenith it shines into the camera lens for an hour or two; then it disappears behind the peaks, leaving them dark silhouettes against the sky. Lacking in detail, afternoon photographs leave much to be desired. So, of course, during my stay in the Tetons the clouds did not lift above the peaks until late morning, or the skies clear until mid-afternoon.

Because of this perversity of light and cloud, the vistas were not as beautiful as they should have been. Jackson Lake was never a gleaming expanse of mirror with snow-clad peaks reflected in it. Nor was Jenny Lake a shining jewel in the midst of the forest. My memories of the Tetons are shrouded with meteorological mist and lens-defying fog.

But, in spite of it all, I think I can be philosophical. At least I have seen the Tetons and the Jackson Hole country. If my photographs thereof are not the most colorful and scenic, at least I have as good a collection of the Tetons in the fog as anyone could hope to take. And, Brother, considering the efforts I made to get them—that's Photographic Philosophy!

This and that

For photographers who have the time, the money, and the interest, the Doscher Country School of Photography offers a series of summer courses in Vermont. The advertising folder makes interesting reading and, according to it, this summer will mark the school's tenth year. Students have come from all age groups, from 44 states and from 14 foreign countries. Beginning in June and continuing into October, the courses usually run from five to twenty sessions; they cover such subjects as miniature techniques, color slides, amateur and advanced movie making, child photography, portraiture and retouching. Professional career courses also are offered from October to April. For further information, write the school at South Woodstock, Vermont.

Yosemite Names

"Place Names of Yosemite Valley" is the title of a recent special issue of Yosemite Nature Notes published by the Yosemite Natural History Association, Box 545, Yosemite National Park, California. It is the work of Richard J. Hartesveldt, Senior Ranger Naturalist, who has done a remarkable job of assembling information on the original Indian names and, if the present name is different, the reason for both. This bulletin adds greatly to the interest of the visitor to the Park. Subscription to Yosemite Nature Notes is $1.50 a year, the funds being devoted entirely to assisting the park naturalist division in furtherance of research and the interpretation of the natural and human story of the Park.

Bermuda

(*continued from page 320*)

remnants of eolian limestone, weathered by the surf to a rounded shape. Their rims have become encrusted with a tangled mass of worm tubes, or serpulae, calcareous algae, corallines, barnacles, mussels, and other small marine invertebrates. Another strange formation in the limestone are the "palmetto stumps." These were once thought to be fossilized stumps of ancient palmetto trees, but are, more probably, circular cavities or potholes lined with a coating more resistant to erosion than the surrounding limestone. These are left standing above the surface when the less resistant rock is eroded.

Bermuda is saved from the down-cutting erosion of surface streams because all rainwater is immediately absorbed by the porous limestone. The lack of gullies and streams, however, robs the islands of a ready supply of vital fresh water. Also, the porosity of the limestone allows sea water to percolate through the rock to contaminate any possible underground collecting pools for fresh water. So the roofs of houses and public buildings are required by law to be whitewashed once a year (to make the limestone impervious to water) and all are equipped with a slanting drain connected to a collecting tank. Also, in some areas, especially near the naval and air force stations, whole limestone hillsides, stripped of soil, are whitewashed and connected to drains and tanks. Secondary sources of water are provided by shallow, horizontal wells, and the ballast of fresh water carried in the tanks of some of the large ocean liners and freighters. But in times of drought the water supply becomes a serious and expensive problem for Bermuda.

Porosity causes another problem. Rainfall, sinking into the limestone, there combines with carbon dioxide to form carbonic acid, and readily dissolves the calcium of the limestone. In places, this underground solution of the limestone has dissolved away great sections of the rock, forming extensive subterranean caves and passageways. Some of these are beautiful with a magnificient tracery of stalagmites and stalactites. The fact that the floors of some caves, which must form above the water table (roughly equivalent to sea level on such a small island), now stand under sixty feet of water, shows that these caves, and hence the whole platform, once stood *at least* sixty feet higher in relation to sea level.

The limestone is also undergoing attack from another source, for extensive quarrying operations are being carried on in many places throughout the islands. The rock in these places is consolidated enough to make an excellent building stone, and nearly all the island buildings are constructed of the blocks. The limestone, when fresh, can easily be cut from a hillside, after removal of the thin top soil. Heavy steel chisels, channeling into the soft stone, divide the rock into blocks, which can be cut into usable rectangular pieces by an ordinary crosscut wood saw. These blocks, when first removed, can be sawed as easily as soft wood, but, upon exposure to air, harden in a few weeks to become a usable building stone.

Thus the Bermudas, which have survived so long in the past, now lie serene and quiet in the blue-green ocean. Volcanoes no longer send forth great sheets of molten lava; great waves do not pound the shores unceasingly; the harsh polar winds no longer roar from the north, heaping up huge dunes. Only the gradual decaying process of erosion continues. Again, as during the interglacial periods, and perhaps for only a moment in its geologic history, the sleepy islands can relax in the tropic sun and let the warm waters and balmy breezes play about the shores.

Moon

(*continued from page 325*)

which culminated in the publication of a complete photographic atlas of the moon.

The field of celestial mechanics and planetary research is represented in moon names by Simon New comb, director of the Nautical Almanac Office, U. S. Naval Observatory, whose studies of planetary motions have yielded fundamental tables that are still in current use for the preparation of ephemerides. Benjamin Peirce, Harvard professor of mathematics, is remembered for his researches on Saturn's rings, and on the perturbations of Uranus and Neptune. Asaph Hall discovered the two satellites of Mars with the 26-inch refractor of the U. S. Naval Observatory. He is also remembered for his work on the diameters of planets, the motions of faint satellites, and the rotation of Saturn.

In recent years, H. P. Wilkins of England has added a few more names to the list of lunar features established by the International Astronomical Union. Among these is that of Chester B. Watts, of the U. S. Naval Observatory, whose extensive survey of the marginal zone of the moon, now nearing completion, is of fundamental importance.

The summer solstice will take place on June 21 at 11:32 P. M., Eastern Standard Time.

The Moon will be full on June 5 and July 5, and the New Moon will occur on June 19 and July 19.

A total eclipse of the sun, invisible in this country, will take place on June 20.

Mercury will be unfavorable for observation in June. In July, it will be in the morning sky, rising about one and one-half hour before the sun on July 15.

Venus may be seen low in the east, just before sunrise in June, and will be lost in the morning twilight in July.

Mars will be setting in the northwest shortly after sunset.

Jupiter will set in the west at about 10 P.M. on June 15, and will gradually be less favorable for observation in July.

On June 15, Saturn will be up in the southeast at sunset, setting at about 2:30 A.M. On July 15, it will be overhead at sunset, setting at about 12:30 A.M.

Wichita

(*continued from page 294*)

amusement center in a picturesque setting visited by 600,000 annually.

The Army also covets one-sixth of the refuge itself—10,700 acres along its south side, to be obtained by paper transfer. They describe this as "waste land." *It is the best part of the Wichita Mountains.* The Army would take beautiful Postoak and Treasure Lakes, Quanah and Bat Cave Mountains, Charons Garden, Twin Rocks and Elk Mountain, Mount Lincoln and Phantom Hill. They would also take superb Eagle Mountain with the spectacular Narrows along Cache Creek and the best camp—Camp Boulder. In short, not only would the Army take away the main entrance, it would acquire the loveliest, most superb parts of the Refuge.

Two years ago the Army tried to buy blocks of land south and north of the Refuge, the northern tract a huge area of 99,360 acres that include Saddle Mountain. This was a pincers movement designed to swallow the Refuge. This attempt was defeated by an outraged citizenry.

The future plans of the military can be guessed. Eventually they want the whole refuge. Yet there is too little water in the region to provide a safe basis for the great expansion envisioned. Moreover, with the rapid advances in military devices, the whole refuge and surrounding countryside would almost certainly soon be too insignificant in size to meet the requirements. So the wilderness would be destroyed to no purpose.

The Artillery School at Fort Sill needs room to fire the newest weapons and guided missiles. The sensible suggestion has been made that for these tests the personnel involved could be flown to desert areas already owned by the government in other states. There the damage would be small in comparison to that planned in the Wichita Mountains Wildlife Refuge.

The fundamental question involved is: Are our National Parks, Monuments, and Wildlife Refuges to be kept inviolate for their higher purposes, and for the happiness of all the people and for our descendants? Or are they going to be exploited by commercial and military interests? Is our own Army, our own Congress going to desecrate these God-given glories of our country?

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Shrews

(*continued from page 297*)

cluded it was a hopeless task to try to keep the little one at home, so it went in and out of the nest at will.

The mother of the little one had never been in good health. It was plain to be seen she did not feel well and she never kept her coat as perfectly groomed as did the male and the other female. I suspect that she had malaria, which is fairly common among elephant shrews. It was for the purpose of experimental work with malaria that the shrews were brought to the United States, but fortunately for their welfare the malaria that afflicts them is of a different type from that of humans, so they were found unsuitable for laboratory studies in such work.

Information obtained in this study of elephant shrews suggests that, in the wild, they are probably equally active by day and night, and that the males, and perhaps the females, also sit on slight elevations to watch the surrounding territory. No doubt they eat a variety of foods other than insects. One, or at most two, young probably constitute a litter and are well developed at birth and ready to be active within a few hours. Their life span is at least three years.

Biblical Zoo

(*continued from page 309*)

many years), Dr. Shulov hopes in time to stock the new woodlands with deer and other animals.

Conservation of soil, water and woodlands, and related activities such as swamp drainage, have been making steady progress in Israel for many years. Wildlife conservation has until recently received less attention. Now, however, a Nature Association has been formed, and has already cooperated with the government in planning appropriate legislation based on the experience of other countries.

Hornbills

(*continued from page 301*)

boring islands in the South Pacific, has a series of overlapping bony ridges above the base of its upper beak, giving it an especially repulsive appearance. This bird has made a deep impression on the New Guinea natives. In the Mt. Hagen area they wear strings of the beaks and casques as a kind of sacred necklace, and the Sepik River tribes often represent it in carvings on house ornaments, images, and dance masks. A favorite stunt is to add the long beak and wrinkled casque to statues of their ancestors, to increase their magic power.

The natives on New Ireland were equally impressed by the wreathed hornbill. They frequently portrayed this bird on their famous wooden pillars, and they still carry wooden heads of them, equipped with wierd shell eyes, when they dance. Probably they used to be frightened by the grotesque birds, as their cousins in New Guinea were, thinking that they had a special kind of magic. Now, they just use them for rites and for ritual ornaments because their fathers did.

Many of the African tribes were also awed by hornbills, and developed some strange legends and beliefs about these birds. Three of the African hornbills are ground birds, differing from the rest of the family in many ways. For example, in addition to having open casques, they have long legs especially developed for walking, while all the other species are adapted for tree-dwelling and have short legs that only permit them to cover the ground in awkward hops. Most hornbills are strictly fruit-eating, but these terrestrial species will swallow anything, even carrion. And they do not nest in holes in trees, as do other hornbills, but make a more conventional nest in the crotch of some tall tree.

African natives regard these ground hornbills with considerable dread. Their strange appearance alone would be enough to terrify superstitious people. They look like a turkey from a distance, but on closer view they are fearsome to see. Furthermore, they are fearless in killing dangerous snakes, usually tackling one in groups of three or more. If this were not awesome enough, the birds have an exceptionally deep and powerful cry that is frightening at night.

Practically all the hornbills make raucous, unbirdlike sounds of considerable volume, but these African ground birds probably outdo all the rest. Explorers who have heard them report that the ground hornbill's two-note call can be heard for well over a mile, and that the second note has a strong booming quality much like the roar of a lion!

Many of the little Ashanti gold weights from the Gold Coast region depict fables about hornbills. Although they look as if they were made of gold, they were actually cast in a light bronze, by the lost-wax process. We call them gold weights because the Negro merchants used them to balance their scales when they were weighing gold dust. Often less than an inch high, they were so well made that their likeness to birds is quite recognizable, even in this small scale.

In another part of Africa, farther east, the Fang tribesmen used hornbill casques for making rattles. They filled the casque with small stones, sealed up the open end, and lashed the beak to a short stick-handle.

Some of the African hornbills had no well-developed casques at all. Several of them, like Cassin's pygmy hornbill, the smallest member of the family, merely had brightly colored beaks, without protuberances. From a distance they might seem much like South American toucans. But the toucan is a quite different kind of bird, with different body structure.

Although the hornbill family is numerous in the Old World, it is by no means complete at the present time. Strange, unexplained gaps separate some species from others. The links between them are now lost. Scientists have suggested that the present species are survivors from a much larger family that once inhabited the great continental mass off southeast Asia, which is now submerged beneath the sea, leaving only the Indonesian islands above water.

If this is true, the hornbills are in a sense "living fossils" from an earlier age. No wonder, then, that they seem so strange compared with the more familiar birds of modern times, and can so easily awaken fears, or laughter, among all who see them.

Red Face Department

Apologies to the great State of South Dakota. In our April issue, in the article entitled "Geronimo's Face," the author lifted up Mount Rushmore and transported it bodily to North Dakota. And we compounded the felony by allowing this error to get into final print. Both of us, of course, knew better. Please pardon us, South Dakota!

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Nature AND THE MICROSCOPE

By JULIAN D. CORRINGTON

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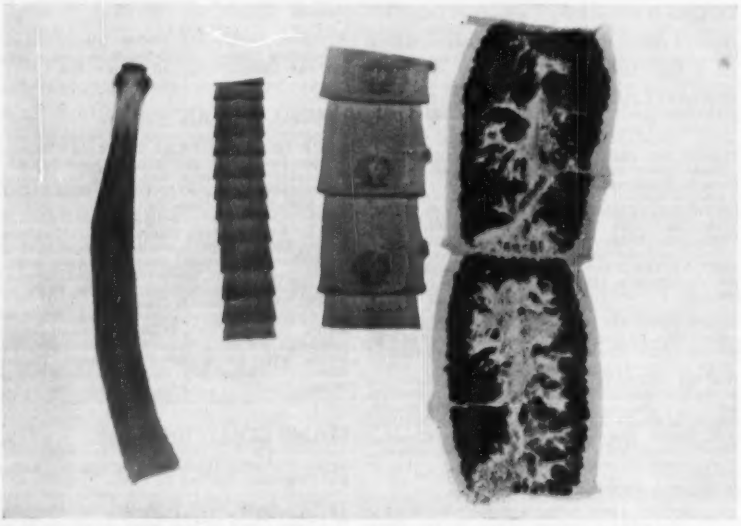
THE MOST fundamental law of life is self-preservation. Most of the adaptations of the non-predatory animals are designed to triumph over those of the predators, and success in maintaining one's self as a living, going concern lies with the individuals having the best defensive equipment, the swiftest modes of escape, the most perfect concealing pattern and coloration, the most vigilant senses. We might phrase a motto for living: To eat, but not to be eaten.

There is one whole way of life, however, whose followers so completely flaunt this law that they have to be eaten in order to live! These are the majority of the internal parasites that inhabit the alimentary canal and its adjunct ducts, including the intestinal amebas, liver flukes, tapeworms, such roundworms as ascaris, and a few insects, as botflies. At some stage of their life cycle they are free, at least for a period sufficient to effect a transfer from one host to another, but in the form of cysts, eggs, embryos, or larvae they are eaten by some animal, an act that is quite essential if their life is to continue and if the race is to survive.

Among all endoparasites (internal parasites), the most profoundly modified for this strange way of life are the tapeworms. How far their alterations from a free-living flatworm like planaria have gone is seen in their complete loss of the entire digestive system, oldest of all systems of organs save possibly the integument. All multicellular animals go through a process of gastrulation—literally the getting of a stomach—as a basic step in early embryology, and the space and energy given over to the digestive system and the processes of obtaining and preparing food for use in the body are very great. Yet tapeworms have managed to dispense with the whole affair, a tremendous loss indeed, viewed from the evolutionary standpoint. This is but one of many vastly interesting specialties in this group, the Class Cestoda.

Those without scientific training are apt to view the rattlesnake with horror and the maggot and tapeworm with loathing, but to the life scientist all forms of life are phenomenal, and the more profound the modification for an unusual way of living, the greater the interest. The biologist treats all aspects of life objectively, without prejudice, and to him there is scarcely an animal group more fascinating than the cestodes. Let us explore a typical life cycle.

Scolex of Dog Tapeworm, with hooks and suckers.



PHOTOMICROGRAPHS FROM SLIDES LOANED BY WARD'S NATURAL SCIENCE ESTABLISHMENT, INC.

Composite slide of Dog Tapeworm, *Taenia pisiformis*, 8.5X.

The Beef Tapeworm

The Beef Tapeworm of Man, *Taenia saginata*, has a worldwide distribution and is the commonest of the larger species parasitizing man. Infection occurs when a person eats raw or insufficiently cooked beef containing *bladderworms* or *cysticerci*, larval stage of this worm. The *scolex*, or so-called "head," inverted in the cysticercus, everts and attaches to the wall of the intestine, the bladder being digested off by the host. The scolex is the complete adult worm at this time, and anchors itself by means of four large *suckers* that project laterally and forward; a cross-section of the scolex appears quadrangular, a cup-shaped sucker at each corner. The scolex tapers to a *neck* and this begins to grow, forming transverse partitions as it increases in length, thus reproducing asexually by a process of budding a serial array of segments, the process termed *strobilation*, and the chain colony a *strobila*. The first segments formed are indistinct, but as they increase in size through continued growth they begin to exhibit greater definiteness of organization. Each segment is a *proglottid*. The tapeworm, then, is not a single animal; rather each proglottid is an animal, although they are integrated in much the same way that separate railway cars are integrated to form a train.

When a train is made up, the compressed-air hoses, electrical and signaling equipment must be coupled so as to run through the entire train of cars. With the tapeworm, there are two pairs of excretory canals and several longitudinal nerve cords that run through the entire strobila.

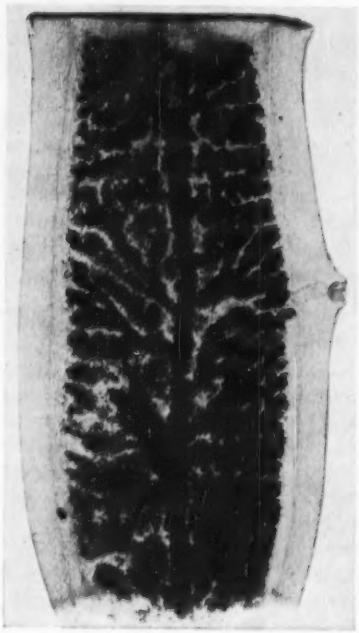
Mature proglottids.

As new proglottids are budded off, the older ones are pushed farther from the scolex; thus the oldest is always the rearmost and the youngest the one next to the neck. As they are forced posteriorly they are increasing in both length and girth and differentiating reproductive organs. Those in the anterior third of the chain are distinguished as *immature proglottids*, are much wider than long, and without completed organs; in the middle third, the region of *mature proglottids*, they are more or less square in outline and have fully developed sex organs; and in the final third, the *gravid proglottids* are much longer than wide, all reproductive structures except the uterus have degenerated, and these individuals are little more than bags full of embryos, ready for the outer world. From one to two thousand proglottids may be present in a full grown *Taenia saginata*, attaining a length of twenty or more feet, with recorded cases as great as fifty feet! This growth requires from nine weeks to three months, starting with a scolex about the size of a pin head, and ending with terminal segments as large as ¼ by ¾ inch.

Mature proglottids exhibit a great array of *testes*, to the number of three or four hundred, mostly laterally and dorsally. Their ducts, like fine threads, connect these minute globules in tree-branching style, leading in to a spot just in rear of the center, from whence the main *sperm duct* runs laterally to a swollen protuberance, the *genital pore*. Here there is a muscular intromittent organ, the *cirrus*, housed in a sac when retracted. Genital pores alternate in irregular fashion from right to left sides of the proglottids.

The Female Organs

The female organs, maturing a bit later than the male, consist of a pair of *ovaries* in the rear fourth of each segment, their much-branched ducts coming together in the center at the *ootype*. Behind the ovaries is the single *yolk* or *vitelline gland* or *vitellarium*, as variously called. *Mehlis' glands* surround the ootype and from it the *vagina* runs out to the genital pore, paralleling the sperm duct, and a straight, slender tube, the *uterus* runs forward in the center and ends blindly. Thus, with the exception of excretory tubes, nerve cords, and some muscles, the entire animal is given over to the needs of the reproductive system. In the life cycles of parasites the great hazard is not in being eaten, as with free-living animals, but in not being eaten, and since the great majority of eggs, embryos, and larvae are destined never to find the next host, there must be an enormous number of them produced that a few may win through and the species survive.



A gravid proglottid.

Fertilization must be internal because of the habitat. As the adults live bathed in digested food, hence require no digestive system of their own, their eggs and sperms would immediately be consumed by the host's digestive ferments were they to be passed into such an environment. It is possible for the sperms of one proglottid to fertilize its own eggs, in an act of self-fertilization; but cross-fertilization is the rule, either between different segments of the same worm (i.e., different individuals with the same parent, a case of incest!) or between proglottids of different worms in the instance of multiple infection of the same host.

The ootype is the fertilized-egg factory. From the ovary comes an endless stream of naked egg cells; from the vitellarium arrive yolk granules to serve as stored food for the future embryo, and secretions which will harden into shells; coming from the *seminal receptacle* at the inner end of the vagina, where sperms are stored after being received, are sperm cells; and from the Mehlis' glands a lubricating fluid. These various components meet much after the fashion of all the parts of an automobile meeting on the assembly line. The egg is fertilized, yolk and shell added, and the finished product then pushed up into the uterus for storage.

Continuing backward in the worm, all these sex organs except the uterus begin to degenerate and thus provide room for an enormous expansion of the uterus, which develops lateral branches, the number and pattern of which are diagnostic of species. *Taenia saginata* has from fifteen to twenty, averaging eighteen, principal branches on each side, and these become packed with eggs, practically filling the proglottid. Penfold found an average of 80,000 eggs per proglottid! Thus loaded, the terminal segments break off, usually one at a time in this species; in others sometimes in short chains of several proglottids. These gravid segments of the beef tapeworm are firm and very active and, says Chandler, when passed they will crawl away like caterpillars. Sometimes

they deposit eggs while still in the host.

Development of Eggs

By the time these proglottids become free-living the eggs have gone through all the earlier phases of development and are mature embryos, hence they are termed *embryonated ova*. We continue to call them "eggs" as a matter of habit and convenience, although the usage is incorrect. Three pairs of minute hooks appear in each embryo, which is thereafter known as an *oncosphere*, also spelled *onchosphere* (hook-ball). A former appellation is *hexacanth* (six-hook) *embryo*, a word which seems to have lost favor with parasitologists of the present or post-Hegnerian generation. Either one or two membranes develop about the tapeworm embryo, within the shell, and the inner of these is the *embryophore* (embryo-bearer). This membrane is ciliated in species where the egg must be deposited in water, but is non-ciliated in *Taenia*. The mature eggs of *Taenia saginata* may be spherical or somewhat oval, and measure from 31 to 43 micra along their greatest diameter. Outside the oncosphere is a clear narrow space, then a thick shell, prominently striated radially. Upon investigation, this shell is found to be the greatly thickened embryophore, and the outer or proper shell remains thin and is usually lost on specimens seen in feces. A shell of some sort is essential to resist digestion in the host and desiccation when free.

On the soil, the egg must be eaten by a cow if the cycle is to be completed, but may remain viable up to two months. In various parts of the world the intermediate host may be any sort of cattle, buffaloes, giraffes, llamas, and pronghorns. The embryophore is digested off and the liberated oncosphere bores through the intestinal wall, entering the blood or lymph channels and is carried about until attaining a skeletal muscle, those of the upper half of the body being especially liable to infestation. Here these embryos grow and transform to larvae called cysticerci (bladder-tail). A large bladderworm measures 6 x 10mm and is elongate-oval in shape, semitransparent, with a denser central spot where the invaginated scolex is formed.

Bladderworms have been known since ancient times; they were termed *measles* and flesh containing them was *measly beef*. Man is the only known final host. It is thought that a single tapeworm may continue to live in its host's intestine for as long as twenty-five years, continuing to produce ripe proglottids at the rate of several hundred per month!

The other important human tapeworm of this genus is *Taenia solium*, the Pork Tapeworm of Man, obtained from eating measly pork that is insufficiently cooked. The adult is somewhat smaller than the beef parasite—800 to 900 proglottids, 6 to 10 feet—and the scolex is provided with an anterior elevation, the *rostellum* (little beak) which carries between 22 and 32 *hooks* or *hooklets* in an upper and a lower row, long ones alternating with short ones. Mature proglottids resemble those of *T. saginata* except that only about half as many testes are present, 150 to 200, and the ovary has three divisions. Eggs of the two species cannot be distinguished and so identification for clinical purposes is made by observing the gravid proglottids; in *T. solium* they are flabby, inactive, and the uterine branches number only 7 to 13, averaging 9, on a side. Man is the only known final host; the hog is the common intermediate host but the cysticerci can develop also in camels, sheep, dogs, monkeys, and man. Human infection with the bladderworm stage can be far more serious than with the adult.

Tapeworms Always With Us

Tapeworms, like the poor, have always been with us. Faust states that both Aristophanes and Aristotle described the pork bladderworm from the tongue of swine. Pratt mentions that the name *taenia* for tapeworm (a ribbon, headband, fillet) occurs in Pliny, and that *taenia solium* was the name given to all common tapeworms in the Middle Ages. Linnaeus named and described the species *Taenia solium* in 1758, and Goeze did the same for *T. saginata* in 1782. Rudolphi, one of the first great parasitologists, founded the Order Cestodes (now Class Cestoda; a girdle) in 1808 to include the adult worms, and the Order Cystici for the bladderworms, as these were considered quite a separate type of animal. A few people, like Goeze, thought there was a relationship between the two, but the majority, as Rudolphi, held that adult tapeworms arose by spontaneous generation in the intestine.

In 1851 Kuchenmeister obtained bladderworms from a rabbit and fed them to a dog, in which he later recovered the adult tapeworm *Taenia pisiformis;* then, feeding ripe proglottids to a rabbit, he secured the cysticerci, thus conclusively proving the complete life cycle by this new, experimental, approach. This study was continued to elucidate the tapeworm parasites of man. In 1855 he worked out the cycle of *T. solium*, and Leuckart solved the same problem in *T. saginata* in 1861. The cysticerci were given to condemned criminals, according to Pratt, and the adult worms found in their intestines after death. These discoveries did away with the taxonomic division, Cystici, and also the names under which the bladderworms had long been classified: *Cysticercus cellulosae* for the larva of the pork tapeworm, and *C. bovis* for that from the cow. Cysticercus then became a descriptive term for a stage, and not the technical name of an animal.

Medically, infection with an adult pork tapeworm is *taeniasis solium* (tea-NIGH-a-sis), with the other species, *taeniasis saginata*, with the pork bladderworm, *cysticercosis cellulosae*. More than 1500 species of tapeworms are known today and doubtless many more remain to be discovered. Ever so often some new and rare case in man is reported.

Fortunately for the student of these animals, tapeworms from dogs and cats will serve admirably as stand-ins for the human species, usually almost impossible to obtain. *Taenia pisiformis*, the species here illustrated, is the customary form to study, and is very like others of its genus. The standard preparation is that shown, with the scolex and three stages of proglottids,—immature, mature, and gravid. Instructions for the making of this slide will be given in a separate article.

We once had a splendid photomicrographic enlargement of this composite slide adorning one wall of our dining room, and visitors invariably remarked on the lovely art work shown in this framed display. "Is it Egyptian?" When told the horrible truth they could only agree that the portrait was hung in the proper location!

Lives of tapeworms all remind us
We should cook our pig and cow,
And, departing, leave behind us
No proglottids for their chow.

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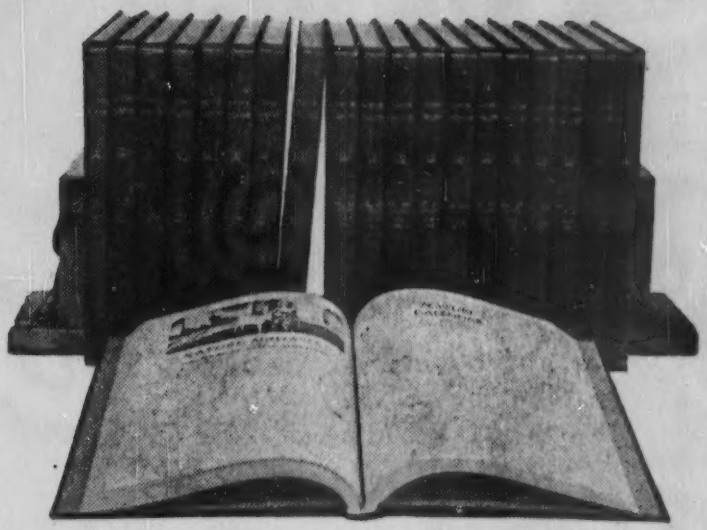

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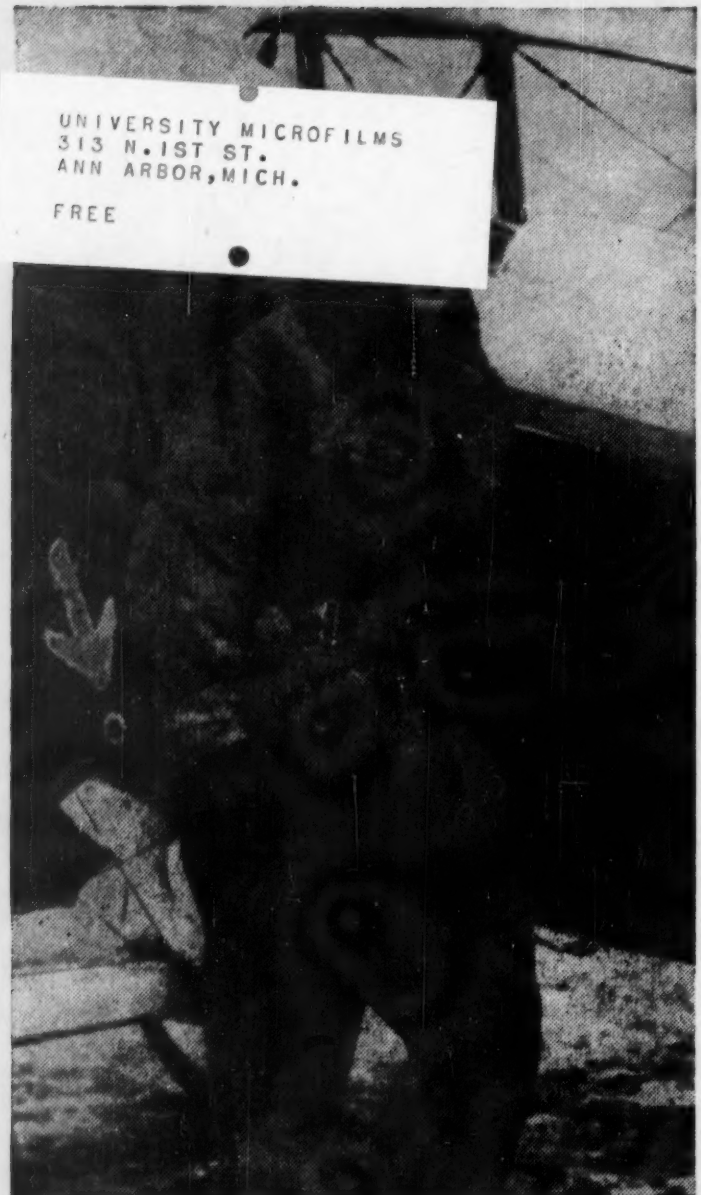

A red-nosed Fokker slowly spun to earth

AT 4:35 P.M., on October 30, 1918, a lone Spad biplane, marked with the symbol of the "Hat-in-the-Ring" Squadron, hawked down through the quiet skies over Grande Pré. Seconds later, a twenty-round burst of its guns smashed full into the center of a low-flying Fokker and sent the German plane swirling earthward like an autumn leaf.

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